

**CITY OF RIVERSIDE
FIRE STATION NUMBER 1
SEISMIC STUDY**

Presented to:

Administrative Services Department
City of Riverside

June 23, 2000

by
Nicoloff and Associates, Inc.

TABLE OF CONTENTS

INTRODUCTION	2
STRUCTURAL MODIFICATIONS	2
CONSTRUCTION COSTS	2
SUMMARY	3
ADDENDUM	

Structural Seismic Review - Fire Station No. 1

INTRODUCTION

Our scope of work for this project was to perform a seismic review of the existing City of Riverside Fire Station No. 1, located at 3420 Seventh Street. We were also tasked with providing an estimate of the probable cost to construct necessary seismic upgrades and related cosmetic repairs.

Constructed in 1955, the two story, 19,000 SF building has been in continuous use as both a fire station and offices for the City of Riverside Fire Department since. The structure utilizes a variety of construction materials and systems including brick, concrete block masonry, poured in place concrete, metal studs and stucco, wood framing and sheathing and steel framing.

This report addresses: 1) the condition of the existing facility; 2) the recommendations to bring the facility up to current seismic requirements as identified in the building code (1997 Uniform Building Code) and the Essential Services Buildings standards (Chapter 4, Article 1. of the 1998 California Building Standards) and good engineering practice; and 3) the cost associated with the repairs to this existing facility.

STRUCTURAL MODIFICATIONS

A specific discussion of the existing condition and requirements for upgrade of the building is attached. This report details the primary structural systems and how these can be enhanced to meet the requirements of the Essential Facilities Act. The report, prepared by Integrated Design Services, Inc., identifies the costs of these specific required upgrades.

CONSTRUCTION COSTS

The cost estimate discussed in the attached structural engineering report focuses on those specific repairs. In addition, costs for repairs to finishes (ie. gypsum board, painting, carpeting, vinyl flooring, tile, acoustical ceiling tile, etc.) and general conditions (ie. Contractor profit and overhead) will need to be included.

General Conditions	\$ 80,000
Structural Upgrade Costs	\$ 440,000
Repair to Finishes	\$ 80,000
Sub Total Construction Costs	\$ 600,000
Design Costs (10% of \$ 600,000)	\$ 60,000
Total	\$ 660,000

Note: Additional moneys will need to be allocated for project management on the part of the City.

SUMMARY

The existing Fire Station No. 1 is an excellent candidate for upgrades. The structure is inherently sound and can be brought up to current code and essential facilities standards relatively inexpensively. Perhaps most important, when compared to the cost of a replacement structure of a similar size - probably (19,000 SF x \$200/SF plus design costs) \$4,180,000 - this appears to be an economical solution to continuing the excellent fire service that the City of Riverside has grown to expect.

STRUCTURAL SEISMIC REVIEW

FIRE STATION NO. 1

**3420 Seventh Street
Riverside, California**

For

**Nicoloff & Associates Inc.
Architecture and Planning
2931 Jarvis Street, Suite B
San Diego, California**

**▲▲ INTEGRATED DESIGN SERVICES, INC.
Structural Engineers**

June 5, 2000

▲▲ INTEGRATED DESIGN SERVICES, INC. (IDS)
Structural Engineers

June 5, 2000

Jim Nicoloff, President
Nicoloff & Assoc., Inc.
Architecture and Planning
2931 Jarvis Street, Suite B
San Diego, California 92106

Subject: Structural Engineering Seismic Review

Fire Station No. 1
3420 Seventh Street
Riverside, California

1.0 INTRODUCTION

Nicoloff & Assoc. requested Integrated Design Services, Inc. (IDS) to provide structural seismic review of Fire Station No. 1 for the City of Riverside. The scope of work includes performing structural evaluation, recommendation of structural strengthening, and estimate of probable construction cost.

The original building was designed by Bolton Caldwell Moise, Jr., AIA Architect in 1955. It consists of a two story office/dormitory wing and an apparatus room and hose tower enclosing 19,000 sq. ft. approximately. The exterior walls are brick, concrete block masonry, poured-in-place concrete and metal studs with stucco. The roof structure in the dormitory wing is wood joists supported by steel beams with 1x6 diagonal wood sheathing. The apparatus room roof is tapered steel girders with steel channel purlins and 2x6 perpendicular wood sheathing. The second floor structure in the office/dormitory wing is unreinforced poured-in-place concrete over steel open web joists, supported by steel beams.

2.0 STRUCTURAL EVALUATION

IDS conducted a site visit for the facility on May 18, 2000. Pictures of the existing conditions of the building (Photo # 1 through Photo #12) are included in the Appendix of this report. We also performed Code (UBC 97) and computer check of the existing building. The Appendix includes the structural calculations performed for this facility. Most of the calculations were performed using Enercalc computer program.

3.0 AREAS OF STRUCTURAL CONCERN

Our structural evaluation indicated that there are several areas in the facility that do not meet the current code requirements for seismic strength. The following is a list of the areas of major structural concern for Fire Station No. 1.

- (1) Overstressed Shear walls: The following walls were found to be overstressed due to seismic shear stresses:
 - A four-foot long section of brick wall on the West Wall on the Second Floor adjacent to the Kitchen.

- The east wall of the Dormitory wing, above the roof of the Apparatus Room. This wall consists of metal studs with a stucco finish.
- The brick walls on the north and south face of the Apparatus room on each side of the roll-up doors.
- The north wall of the Dormitory wing at second floor. This wall is 8" metal studs and stucco with no apparent shear resisting elements.
- The first floor walls of the Office/Dormitory wing, facing south.
- The north facing brick walls of the Office/Dormitory wing at first floor
- The line of pipe columns on the first floor of the Office/Dormitory along the north face of the building.

(2) Overstressed diaphragms and wall connections: The following diaphragm elements were found to be overstressed due to seismic forces:

- The wood roof of the Dormitory and the Apparatus room
- The in-plane ledger connection of the wood roof structure to the existing brick or block walls. The connection is overstressed due to shear stresses. The ledger is also overstressed in 'cross-grain' bending.
- The steel angle ledger attachment to the Apparatus Room brick walls. The ledger is overstressed due to in-plane and out-of-plane seismic forces. The ledger was found inadequate to transfer shear loads and to keep the brick wall from pulling away from the roof.
- The second floor structure at the Office/Dormitory wing: This floor consists of unreinforced poured-in-place concrete. The diaphragm is inadequate when subjected to design seismic loads.

(3) Overstressed Foundation: The following foundations were found to be overstressed due to overturning and uplift seismic forces

- The footing along the south wall of the Office/Dormitory wing
- The concrete footing along the north wall of the Office/Dormitory wing
- The hose tower footings
- The footings under the north and south brick walls of the Apparatus room

(4) Unbraced equipment and nonstructural elements: The following nonstructural elements or equipment are not adequately braced against seismic loading:

- The Emergency Generator (photo #8) and diesel fuel tank.
- Roof-top equipment. See photos #9 and #10.
- Suspended pipes (photo #11).
- The header above the roll-up doors. The bracing has been removed. See photo #12

(5) Areas need Repair:

- The bricks on the walls at the jambs above the overhead doors on the north and south facing walls of the Apparatus Room are cracked.

4.0 RECOMMENDATIONS FOR STRUCTURAL STRENGTHENING

The above areas of structural concern could be mitigated by implementing several strengthening measures. These measures include the following:

(1) Strengthen Diaphragm Elements, which include:

- The roofs over the Office/Dormitory and Apparatus rooms: Provide new plywood with adequate nailing over the existing wood boards.
- The roof ledgers at the Office/Dormitory: Provide new epoxy bolts from the ledger to the existing masonry walls. Provide new steel washer plates under existing and new anchor bolts for the ledger to mitigate 'cross-grain' bending.
- The second floor diaphragm of the Office/Dormitory wing: providing new tube steel bracing under the existing open web steel joists, or add new fiber reinforced composite coating on top of the entire floor slab.

(2) Strengthen Existing walls to increase seismic shear resistance. This includes:

- The four foot second floor wall on the west of the Office/Dormitory wing adjacent to the kitchen. Add reinforced concrete gunnite with dowels into the existing masonry, or provide fiber reinforced composite coating on the interior of the wall.
- The east wall of the Dormitory wing, above the roof of the Apparatus Room: Provide new shear resisting elements along this wall. The strengthening options include adding plywood and holddowns to the existing metal studs, or adding diagonal steel straps and holddown anchors to the metal studs.
- The north wall of the Dormitory wing, second floor: One option would be to add plywood and holddowns to the existing studs on the interior wall 16 feet south of the existing metal stud north wall.
- The brick walls on the north and south facing partitions in the Apparatus room on both sides of the roll-up doors. Strengthening options include adding reinforced concrete gunnite with dowels into the existing masonry, or providing a fiber reinforced composite coating on the interior of the walls.
- The brick walls facing south on the first floor of the Office wing: Strengthening Options include adding reinforced concrete gunnite with dowels into the existing masonry, or providing a fiber reinforced composite coating on the interior of the walls.
- The brick walls facing north on the first floor of the Office wing: Strengthening Options include adding reinforced concrete gunnite with dowels into the existing masonry, or providing a fiber reinforced composite coating on the interior of the walls.
- Add new shear elements along the pipe columns located at the north side of the first floor of the Office wing. The strengthening options include adding a welded steel moment frame, or a new brick shear wall in line with the existing pipe columns.

(3) Add seismic bracing for non-structural elements:

- The emergency generator and the diesel fuel tanks should be braced to prevent damage or rupture during an earthquake. They should be anchored to the foundation to resist lateral movement.
- The roof-top equipment including air-conditioning and satellite communications equipment should be braced for lateral movement to prevent down-time during an emergency.
- The hanging pipes should be braced for a seismic shaking.
- The braces above the roll-up doors should be replaced to provide the required lateral bracing for the truss-type header above the large openings.

(4) Strengthen foundation elements for overturning seismic resistance: This includes:

- The footing along the south wall of the Office wing, first floor: Provide new footings under the existing concrete in sections with epoxy dowels into the existing concrete.
- The concrete footing along the north wall of the Office wing at the first floor. Provide new footings under the existing concrete in sections with epoxy dowels into the existing concrete.
- The hose tower footings. Provide new footings under the existing concrete in sections with epoxy dowels into the existing concrete.
- The footings under the north and south walls of the Apparatus room. Provide new footings under the existing concrete in sections with epoxy dowels into the existing concrete.

(5) Repair damaged areas. The brick above the jamb on the walls above the overhead doors on the north and south facing is cracked. The cracked brick units need to be removed and replaced to match existing.

5.0 ESTIMATE OF PROBABLE CONSTRUCTION COSTS

The following is an approximate estimate of the probable construction cost to implement the strengthening measures indicated in Section 4.0. Total cost of construction is estimated at \$440,000.

-00o -

6.0 CONCLUSION

Several areas of structural seismic concerns were identified for the Fire Station No. 1 of the City of Riverside. The wood roof diaphragms of the Office/Dormitory wing, Apparatus room, and hose tower are inadequate. The wood ledger connection at the roof of the Office/Dormitory wing should be strengthened. The un-reinforced second floor concrete slab of the Office/Dormitory wing is not adequate for diaphragm loads. Several of the walls on the first and second floors of the building do not have sufficient strength for the expected earthquake loads. Many of the existing footings under shear walls are insufficient for strong ground shaking. There are broken bricks above the jambs of the roll-up doors to the Apparatus Room.

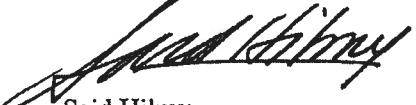
These deficiencies are common for similar buildings constructed in the 1950's. We strongly recommended implementing the seismic strengthening measures as indicated in this report.

Thank you for the opportunity to participate in this study. If you have any questions regarding our findings or recommendations, please do no hesitate to contact us.

Respectfully
Integrated Design Services



Robert Freeman,
Project Manager


Said Hilmy
Principal Structural Engineer

Cc: Central Files

APPENDIX

RIVERSIDE FIRE STATION NO. 1
PHOTOGRAPHS

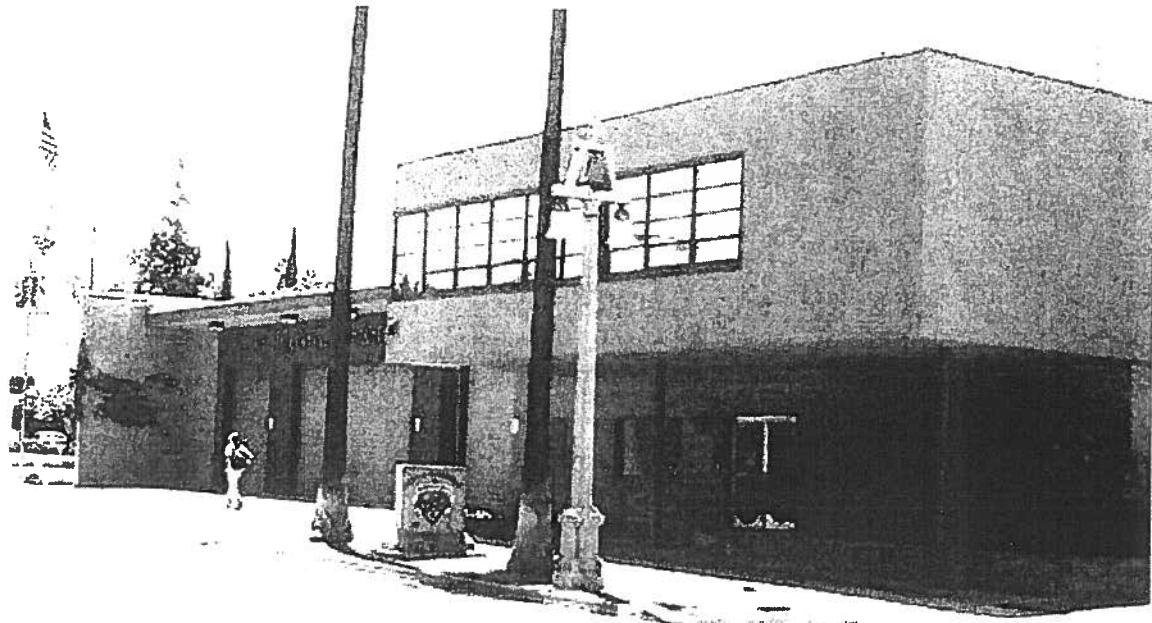


Photo No. 1
North-West corner

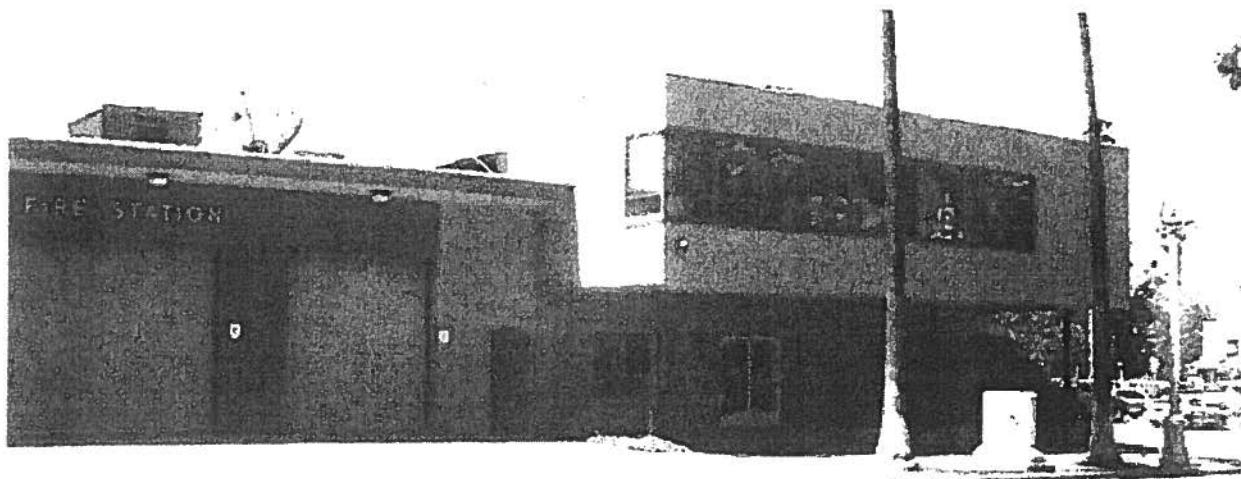


Photo No. 2
North facing wall

RIVERSIDE FIRE STATION NO. 1
PHOTOGRAPHS



Photo No. 3
East Wall

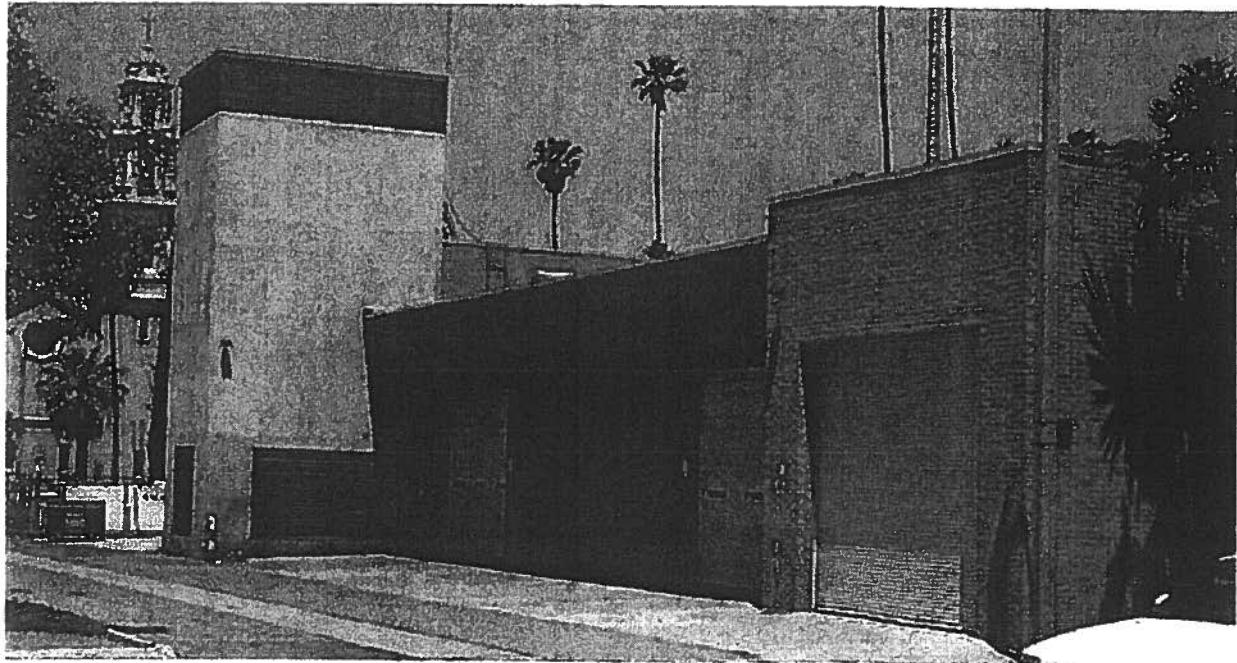


Photo No. 4
South Wall

RIVERSIDE FIRE STATION NO. 1
PHOTOGRAPHS

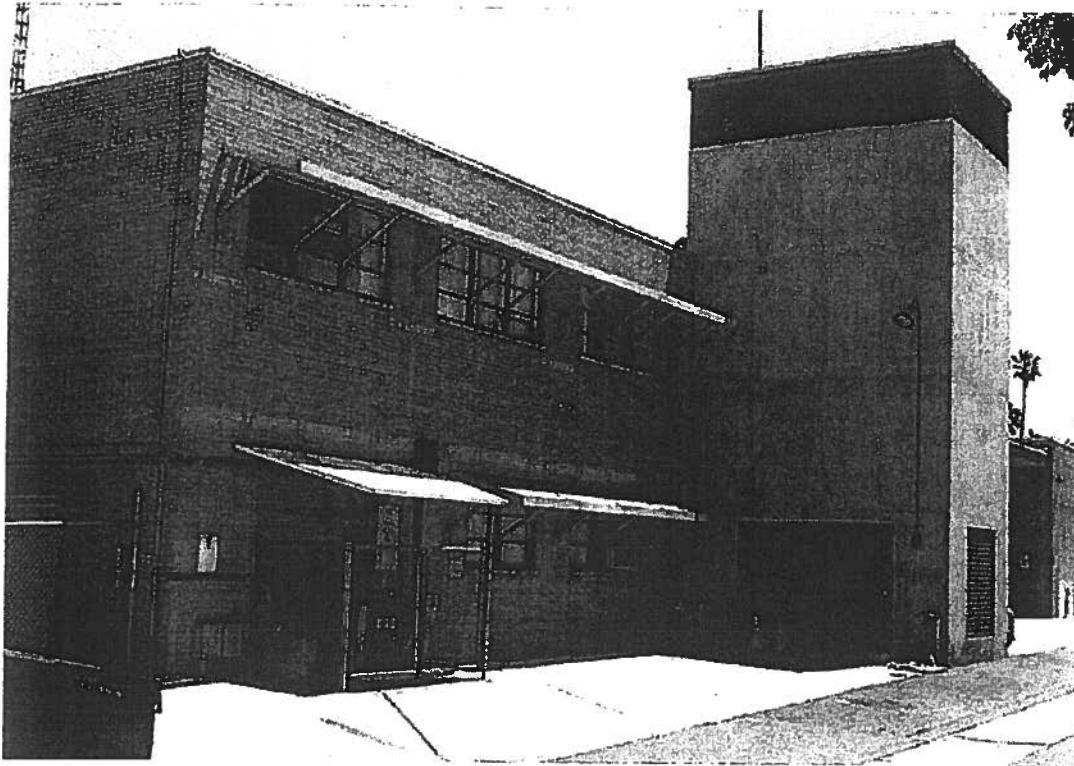


Photo No. 5
South Wall

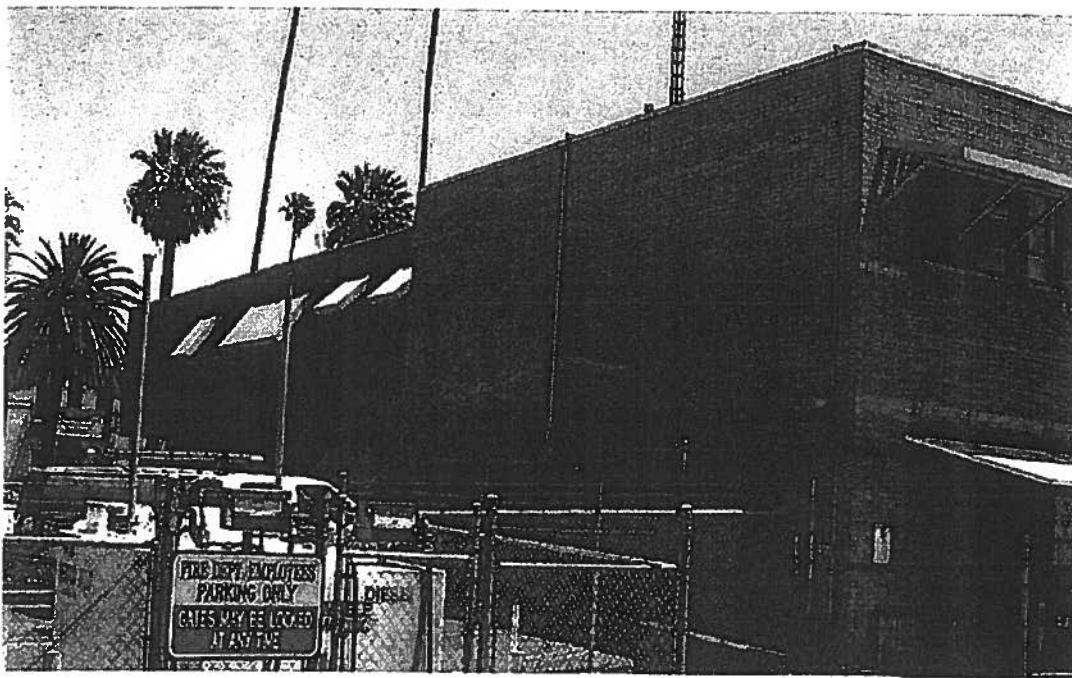


Photo No. 6
West Wall

RIVERSIDE FIRE STATION NO. 1
PHOTOGRAPHS

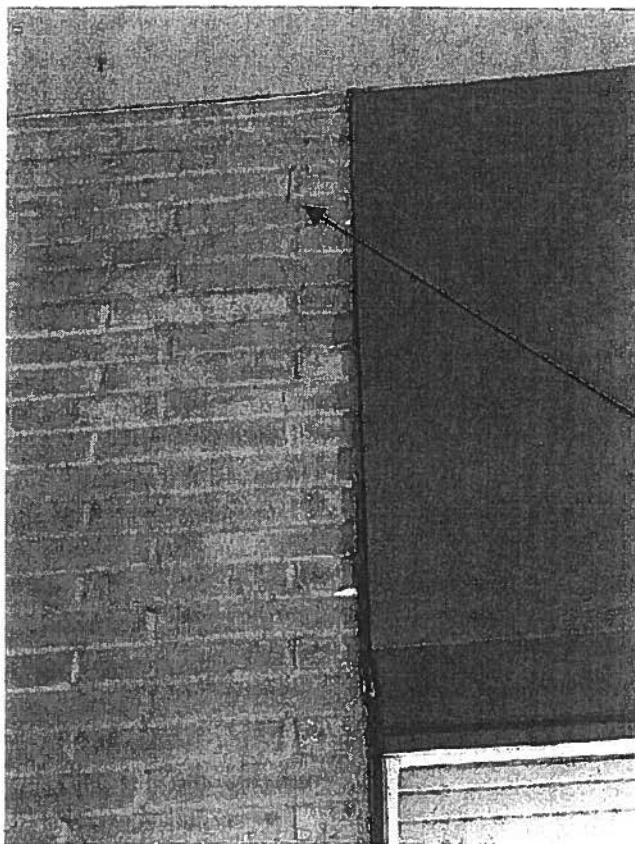


Photo No. 7
Cracked Brick at Jamb
above roll-up doors

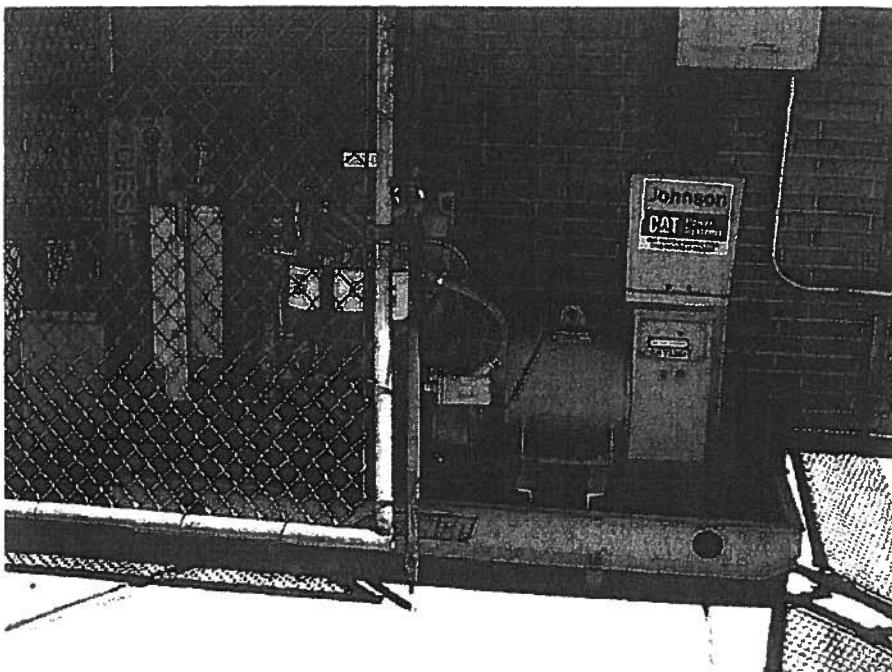
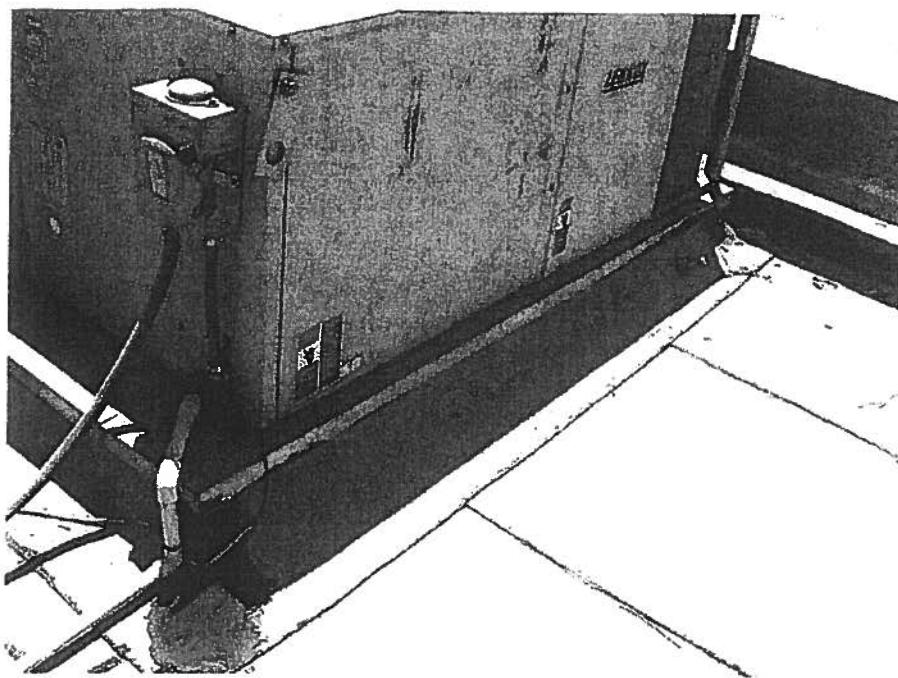
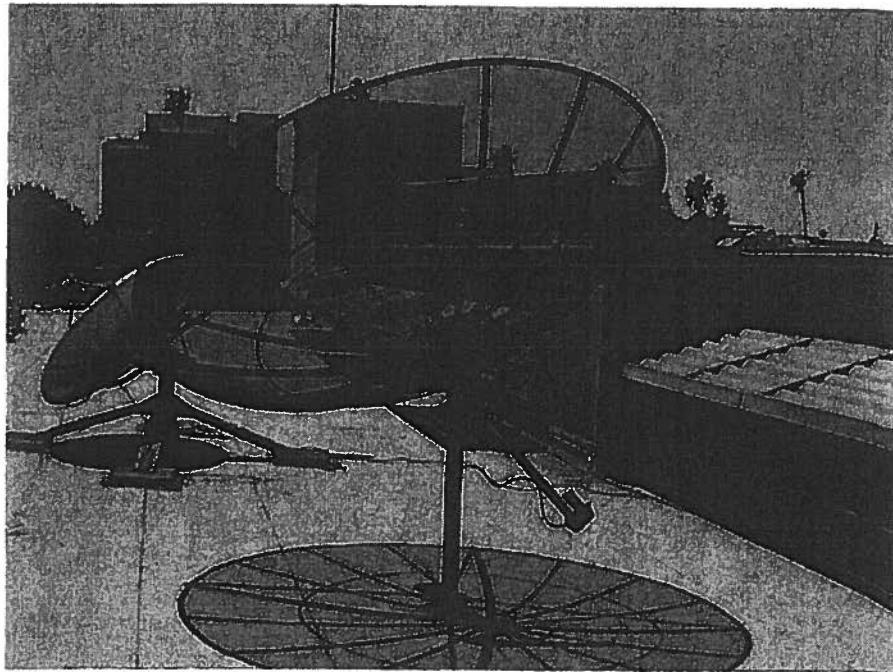


Photo No. 8
Emergency Generator

**RIVERSIDE FIRE STATION NO. 1
PHOTOGRAPHS**



**Photo No. 9
Roof-top equipment**



**Photo No. 10
Roof-top Communications
Equipment**

RIVERSIDE FIRE STATION NO. 1
PHOTOGRAPHS

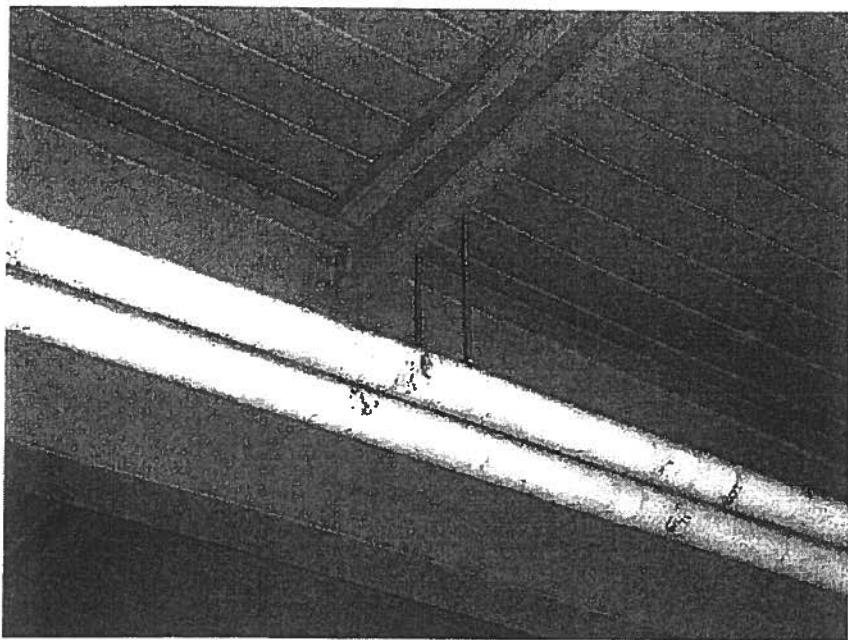


Photo No. 11
Suspended Pipes

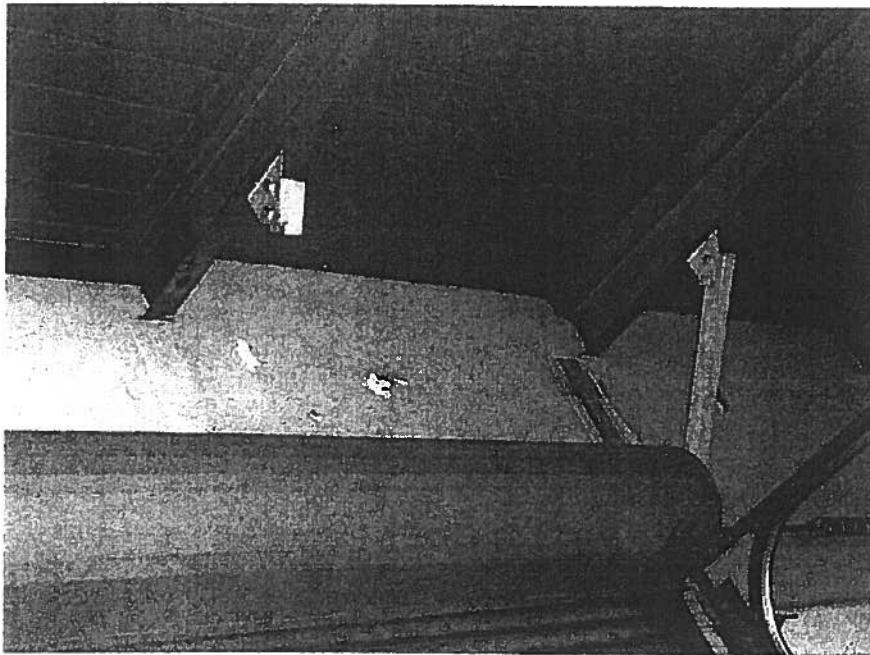


Photo No. 12
Cut bracing at headers
above roll-up doors

RIVERSIDE FIRE STATION NO. 1
PHOTOGRAPHS

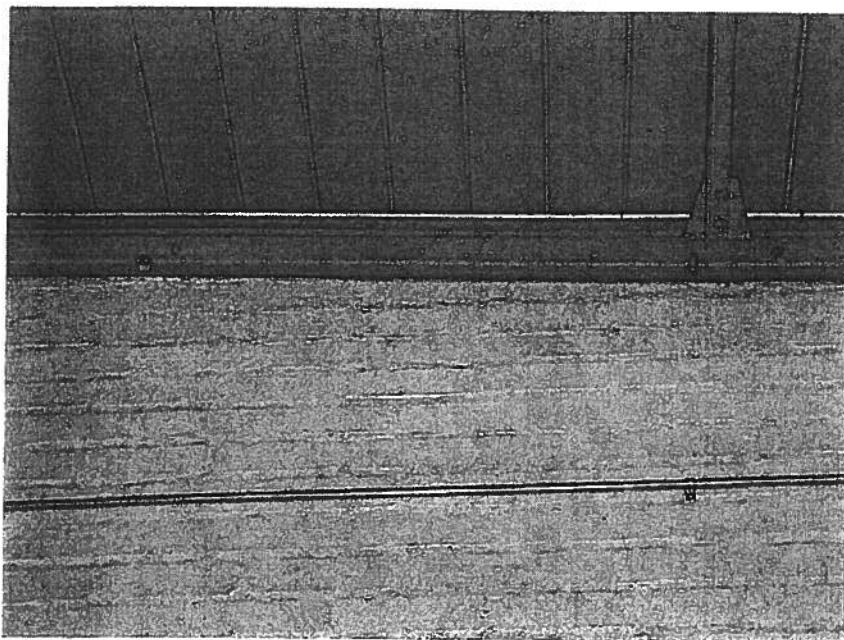


Photo No. 13
Steel Angle Ledger in
Apparatus Room

**STRUCTURAL CALCULATIONS
OF**

**FIRE STATION No. 1
STRUCTURAL SEISMIC REPORT
3420 SEVENTH STREET
RIVERSIDE, CALIFORNIA**

FOR

**NICOLOFF & ASSOCIATES, INC.
ARCHITECTURE AND PLANNING
2931 JARVIS STREET, SUITE B
SAN DIEGO, CALIFORNIA 92106**

BY

**▲▲ INTEGRATED DESIGN SERVICES, INC.
Structural Engineers**

▲▲ INTEGRATED DESIGN SERVICES, INC.
Structural Engineers

SUBJECT: RIVERSIDE FIRE STATION #1

JOB NO. :

SHEET

OF

DESIGNED: RF

DATE: 5-31-00

CHECKED:

DATE:

**TRIBUTARY WEIGHT
ROOF (DORM AREA)**

BUILT UP ROOF	2 psf
1x6 DAG SHTG	2.5
2x12 @ 2 1/4%	2.34
INSUL.	3
GYP. BD (1/2")	2.5 psf
MISC.	<u>8 psf</u>
SUB TOT	20.34 psf

ROOF APPARATUS

BUILT UP ROOF	2
2x8 SHTG	5.0
STEEL FRAMING	3.0
MISC.	<u>8.0</u>
SUB TOT	18 psf.

Floor

2 1/2" CONC SLAB	31.3 psf.
12" OPEN WEB JSTS @ 2 1/4%"	3.0 psf.
1/2" DRYWALL	2.5 psf
INSUL.	3.0
MISC.	<u>8.0</u>
SUB TOT:	48 psf.

LIVE LOADS

Roof 20
Floor. 50

▲▲ INTEGRATED DESIGN SERVICES, INC.
Structural Engineers

	JOB NO. :
SUBJECT:	SHEET OF
	DESIGNED : DATE :
	CHECKED : DATE :

BUILDING LOADS

N-S DIRECTION

WEIGHT OF 1' WIDE STRIP OF DORM ROOF LEVEL

$$\text{ROOF } 12'-2'' \times 20.34 \text{ psf} = 228 \text{ plf.}$$

$$\text{WALLS } (11' \div 2 \times 15 \text{ psf}) + 12.25 \div 2 \times 90 \text{ psf} = 634 \text{ plf.}$$

MET. STUDS (9" BRICK)

$$\text{SUB. TOT. } 2915 \text{ plf} \times 52\frac{1}{4}'' = 152.5 \text{ k}$$

WEIGHT OF 1' WIDE STRIP OF SECOND FLOOR LEVEL

$$12'-2'' \times 46 \text{ psf} = 533.9 \text{ plf.}$$

$$\text{WALLS } (11'-8'' \div 2 \times 110 \text{ psf}) + (11 \div 2 \times 15 \text{ psf}) = 724 \text{ plf.}$$

(11" BRICK) (MET. STUDS)

$$\text{SUB. TOT. } 6113 \text{ plf} \times 52\frac{1}{4}'' = 320 \text{ k}$$

WEIGHT OF 1' WIDE STRIP OF APPARATUS ROOF

$$102' \times 18 \text{ psf} = 1838 \text{ plf.}$$

$$1838 \text{ plf} \times 65' = 119.5 \text{ k}$$

TOWER - E-W DIRECTION

WEIGHT OF 1' WIDE STRIP OF ROOF LEVEL

$$\text{ROOF } 20.34 \times 13.0' = 264 \text{ plf.}$$

$$\text{WALLS } 32' \div 2 \times .66' \times 150 \text{ psf} = 1584 \text{ plf.}$$

HEIGHT THK

$$1548 \text{ plf.}$$

$$1048 \times 17.58' = 32.5 \text{ k}$$

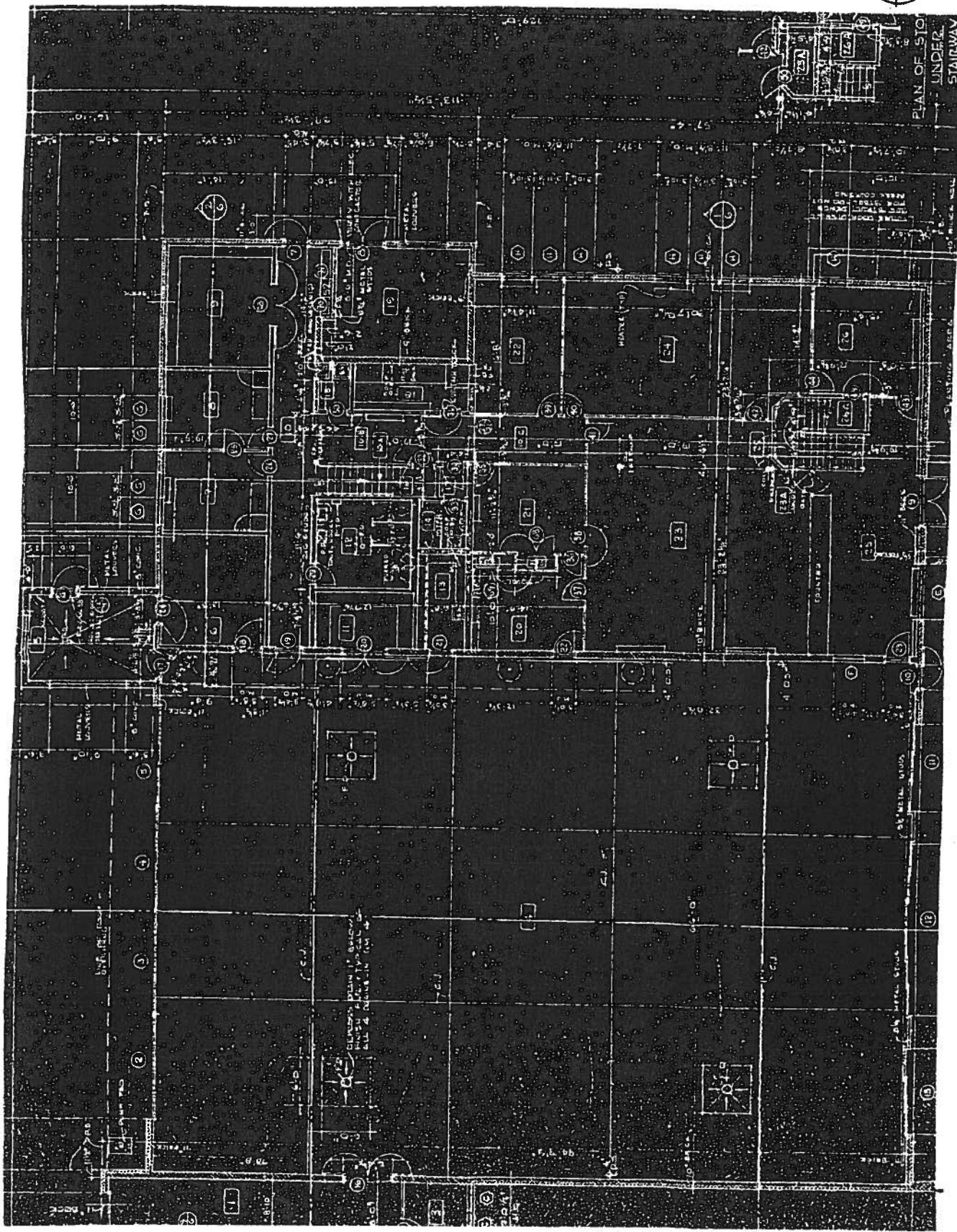
plf.

FIRST FLOOR PLAN

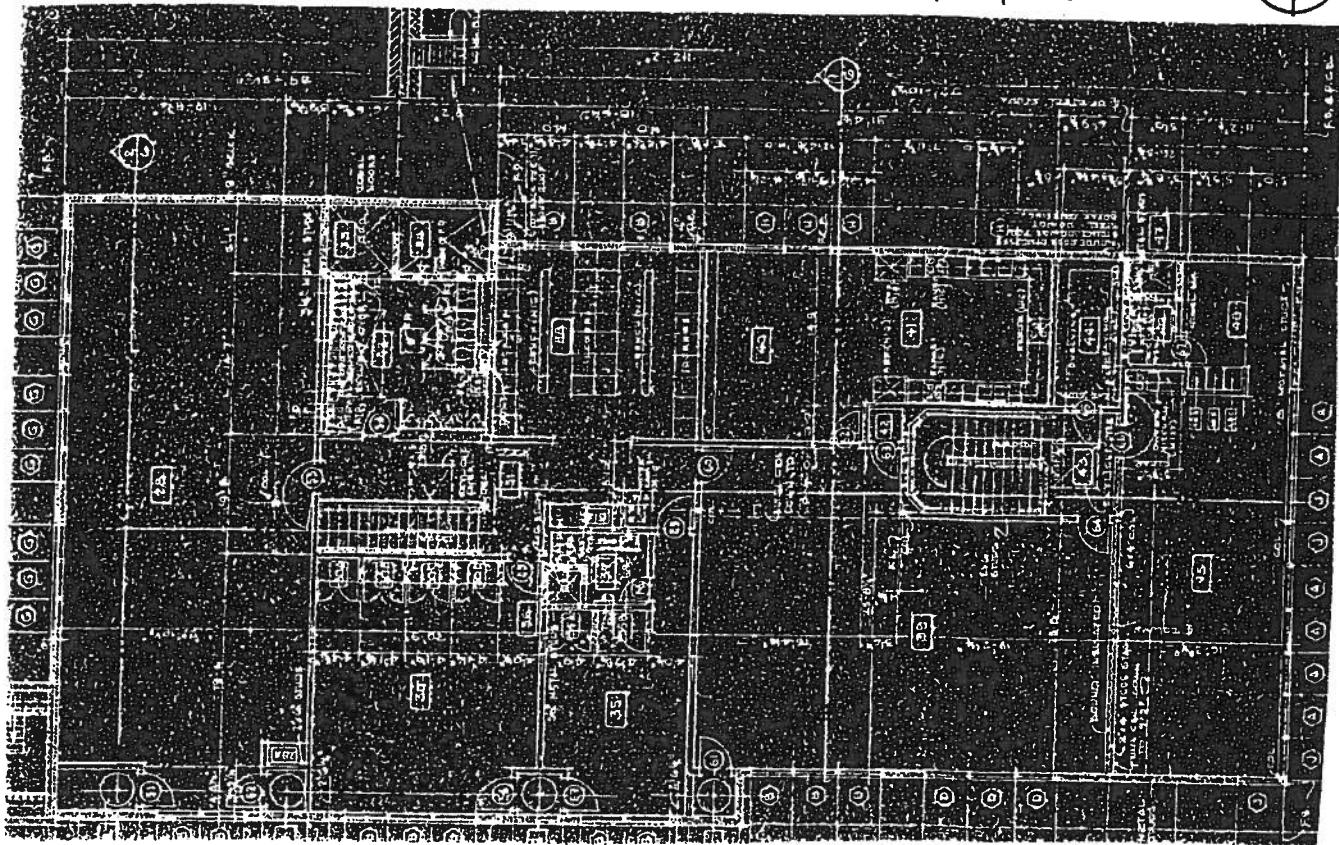


NORTH

PLAN OF STO
UNDER
STAIRWAY



SECOND FLOOR PLAN



Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 11:29AM, 31 MAY 00
Description : Collection of example problems

Scope : All programs in the Structural Engineering Library

Rev: 510002
User: RW-0602970, Ver 5.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Multi-Story Seismic Forces

Page 1

c:\enercalc\examples.ecw:Analysis Calcs

Description Riverside Fire Station No. 1

General Information

Seismic Zone	4
UBC 1630.2.3 Simplified Static Force Procedure	
Ground Floor Area	12,500.0 ft ²
Occupancy Category	Essential Facility
Seismic Importance Factor	I = 1.25
Determine Na & Nv...	
Site Distance From Known Source	>10km
Seismic Source Type	
A : Faults Capable of Large Quakes & High Seismic Activity	
Seismic Coefficients	Na = 1.00 Nv = 1.00
Soil Profile Type	SD
Seismic Coefficients	Ca = 0.44 Cv = 0.64
Structural System...	
Bearing Wall System : 2b:Shear Walls, Masonry	
2b:Shear Walls, Masonry	
Oversrength & Global Ductility Coefficient R =	4.500
Seismic Force Amplification Factor Omega =	2.800
Structure Height Limit	160.0 ft

Calculations are designed to 1997 UBC Requirements

Building period	0.210 sec
Hn to Top Level	23.00 ft
Ct : Construction Type Factor	0.020
Max Element Story Shear R :max	1.00
p : Reliability Factor = 2 - 20/(r:max *sqr)	1.5000

Calculated Values : UBC 1630.2.1

Seismic Dead Load (Calculated From S Table on "Building Forces" Tab	W =	592.0 k
Calculated Base Shear V=Cv I W / (RT)=	501.0 k	
Min.Base Shear V = 0.11 Ca I W =	35.8 k	
Zone 4: Min.Base Shear = 0.8 Z Nv I R / W =	52.6 k	
Base Shear Max Limit V = 2.5 Ca I W / R =	180.9 k	

Final Calculated Values		
Horiz Seismic Factor	Eh / W =	0.306
Vertical Seismic Factor	Ev / D =	0.275
V :Design Base Shear		180.9 k
Ft : Top Force		0.000 k
Eh *p		271.3 k
Em = Omega * Eh		506.5 k

Building Seismic Forces

Level	Weight	Height	Wi * Hi	Ft	Fx	Lateral	Story Shear	Story Moment
	Level	Wi	Hi	Wi * Hi	Ft	Force @ Level	Force	k-ft
		k	ft	k-ft	k	k	k	k-ft
4	152.50	23.00	3,507.5		68.222	68.222		
3	119.50	17.25	2,061.4		40.094	40.094	68.222	392.275
2	320.00	11.66	3,731.2		72.573	72.573	108.316	997.762
1	0.00	0.00	0.0		0.000	0.000		

Total Base Shear 180.889 k
Base Overturning Moment 3,106.927 k-ft

Diaphragm Forces

Level	Weight	Lateral Force	Summation of	Summation of	Max Req'd	Diaphragm	
	Level	Wpx	@ this Level	Lateral Forces Above	Level Weights	Force @ Level	Force : Fpx
		k	k	k-ft	k	k	k
4	152.50	68.22	68.22		152.500	45.750	45.750
3	119.50	40.09	108.32		272.000	35.850	35.850
2	320.00	72.57	180.89 - 160.8		592.000	96.000	96.000
1	0.00	0.00	0.00		0.000	0.000	0.000

▲▲ INTEGRATED DESIGN SERVICES, INC.
Structural Engineers

SUBJECT:

JOB NO.:

SHEET

OF

DESIGNED: RP

DATE: 5-31-00

CHECKED:

DATE:

OK. DRAFTS.

N-S DIRECTION - DORM ROOF
DORM ROOF

$$45.75^F + 2 \div 112' - 2' = 204 \text{ plf}$$

(E) 1x6 DAS WOOD STG

BOUNDARY 2-3 d/BOARD

FIELD 2-3 d/BOARD (act. 75 plf) ∴ NO. GOOD

PROVIDE NEW

PLYWOOD ROOF STG.

APPARATUS Roof

$$35.85^F + 2 + 102' = 176 \text{ plf}$$

(E) 2x8 T/G +

BOUNDARY 3-16 1/2 BD

FIELD 3-16 1/2 BD (act. 100 plf) ∴ NO. GOOD

PROVIDE NEW

PLYWOOD ROOF STG.

SECOND FLOOR

$$96.0^F + 2 + 112' - 2' = 428 \text{ plf}$$

(E) UNREINFORCED 2 1/2" THK CONC. SLAB → ∴ NO. GOOD

PROVIDE NEW STEEL
BRACING UNDER
STEEL JOISTS OR
NEW FIBER REINFORCED
FABRIC COATING
ON TOP OF SLAB.

▲▲ INTEGRATED DESIGN SERVICES, INC.
Structural Engineers

SUBJECT:

JOB NO. :

SHEET

OF

DESIGNED :

DATE :

CHECKED :

DATE :

WIND LOAD APPARATUS ROOM.

$$P = C_a C_d g_s I_w$$

$$= (1.13) (1.3) (12.6) (1.15)$$

$$= 21.3 \text{ psf}$$

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 12:09PM, 1 JUN 00
Description : Collection of example problems

Scope : All programs in the Structural Engineering Library

Rev: 510002
User: KM-0602970, Ver 5.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Masonry Wall Design

Page 1

c:\enercalc\examples.ecw:Masonry Calcs

Description Riverside Fire Station No. 1-Apparatus Room-East Wall

General Information

		Calculations are designed to 1997 UBC Requirements			
Wall Height	16.00 ft	Seismic Factor	0.3060	F'm	1,500.0 psi
Parapet Height	2.50 ft	Calc of Em = fm *	1,500.00	F's	24,000.0 psi
Thickness	10.0 in	Duration Factor	1.330	No Special Inspection	
Rebar Size	4	Wall Wt Mult.	1.000	Solid Grouted	
Rebar Spacing	18 in			Normal Weight Block	
Depth to Rebar	4.750 in	@ Center		Equivalent	
				Solid Thickness	9.620 in

Loads

Uniform Load		Concentric Axial Load		Wind Load	
Dead Load	54.00 #/ft	Dead Load	0.000 #/ft		
Live Load	60.000 #/ft	Live Load	0.000 #/ft		
Load Eccentricity	6.000 in	Roof Load			
Roof Load					

Design Values

E	2,250,000 psi	Rebar Area	0.133 in ²	np	0.03015	j	0.92758
n : Es / Em	12.889	Radius of Gyration	2.779 in	k	0.21725	j / k	9.92458
Wall Weight	104.000 psf	Moment of Inertia	891.670 in ⁴				
Max Allow Axial Stress =	0.25 fm (1-(h/140)^2) * SpInsP		141.84 psi				
Allow Masonry Bending Stress =	0.33 fm * SpInsP =		247.50 psi				
Allow Steel Bending Stress =			24,000.00 psi				

Load Combination & Stress Details Summary

	Moment	Axial Load	Bending Stresses	Axial Compression	Maximum:
	In-#	lbs	Steel psi	Masonry psi	fb/Fb + fa/Fa
Top of Wall					
DL + LL	684.0	114.0	1,164.3	25.1	0.99
DL + LL + Wind	1,122.7	54.0	1,911.2	41.2	0.47
DL + LL + Seismic	1,517.4	54.0	2,582.9	55.6	0.47
Between Base & Top of Wall					
DL + LL	342.0	1,206.0	582.2	12.5	10.45
DL + LL + Wind	7,943.5	1,146.0	13,521.6	291.2	9.93
DL + LL + Seismic	11,789.3	1,146.0	20,068.0	432.1	9.93
					1.8160

Summary

Wall Overstressed

16.00ft high wall with 2.50ft parapet, Normal Block w/ 10.00in wall w/ #4 bars at 18.00ino.c. at center

Governing Load Combination is.... Dead + Live + Seismic Between Top & Bottom

Masonry Bending Stress 432.15 psi

Steel Bending Stress 20,068.02 psi

Masonry Axial Stress 9.93 psi

Combined Stress Ratio 1.8160 > 1.3300 (allowable), NO GOOD

Final Loads & Moments

Wall Weight moment @ Mid Ht	1,092.00 lbs	Wind Moment @ Mid Ht	7,784.70 in-
Dead Load Moment @ Top of Wall	324.00 in-	Seismic Moment @ Mid Ht	11,631.00 in-
Dead Load Moment @ Mid Ht	162.00 in-	Total Dead Load	54.00 lbs
Live Load Moment @ Top of Wall	360.00 in-	Total Live Load	60.00 lbs
Live Load Moment @ Mid Ht	180.00 in-		
Maximum Allow Moment for Applied Axial Load =		6,751.99 in-	
Maximum Allow Axial Load for Applied Moment =		16,374.45 lbs	

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 5:05PM, 31 MAY 00
Description : Collection of example problems
Scope : All programs in the Structural Engineering Library

Rev: 510002
User: RW-0602970, Ver 5.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Masonry Pier Analysis & Design

Page 1

c:\enercalc\examples.ecw:Masonry Calcs

Description Riverside Fire Station No. 1 Apparatus Room-East Wall

General Information

Calculations are designed to 1997 UBC Requirements		
Total Lateral Force	20.05 k	Modul: Em = fm * 1,500.00
Seismic Zone	4	Modul: Ev = fm * 0.40
Load Duration Factor	1.33	

Shear Pier Data

	Pier #1	Pier #2
Pier Height	18.66 ft	18.66 ft
Pier Length	29.33 ft	77.00 ft
Wall Thickness	10 in	10 in
"J" : Depth Mult.	0.89	0.90
Pier Fixity	Pin-Fix	Pin-Fix
f'm	1,500 psi	1,500 psi
F's	24,000 psi	24,000 psi
Sp Insp	No	No
Grout Spacing	24 in	16 in

Analysis Data

	Pier #1	Pier #2
Height/Length	0.6362	0.2423
(H/L)^3	0.2575	0.0142
Rel. Defl	127.2875	48.4701
Sum Rigidity	28.49	
Rigidity = .001/Defl	7.856	20.631
% Force to Pier	0.28	0.72
Shear to Pier	5.529 k	14.521 k
Relative Defl * 10^5	12.73 in	0.00 in
M / (V*Depth)	0.636	0.242

Summary

	Pier #1	Pier #2
Shear Reinforcing...		
fv=V/(12*est*d)	4.20 psi	3.64 psi
Fv: w/o Reinf.	28.88 psi	32.26 psi
Fv: w/ Reinf.	43.32 psi	48.39 psi
Horiz. Shear Av Req'd	Not Req'd in^2/ft	Not Req'd in^2/ft
		✓ OK .
Bending Reinforcing...		
Moment @ End	103.18 k-ft	270.96 k-ft
"d" to tension As	26.10 ft	69.30 ft
Bending As Req'd	0.12 in^2	0.12 in^2

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 12:41PM, 1 JUN 00
Description : Collection of example problems
Scope : All programs in the Structural Engineering Library

Rev: 510002
User: KW-0602970, Ver 5.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Masonry Pier Analysis & Design

Page 1

c:\enercalc\examples.ecw:Masonry Calcs

Description Riverside Fire Station No. 1 North Wall-Apparatus

General Information

Calculations are designed to 1997 UBC Requirements

Total Lateral Force	54.15 k	Moduli: Em = fm * 1,500.00
Seismic Zone	4	Moduli: Ev = fm * 0.40
Load Duration Factor	1.33	

Shear Pier Data

	Pier #1	Pier #2
Pier Height	16.00 ft	16.00 ft
Pier Length	4.25 ft	7.25 ft
Wall Thickness	10 in	10 in
"J" : Depth Mult.	0.89	0.90
Pier Fixity	Pin-Fix	Pin-Fix
fm	1,500 psi	1,500 psi
Fs	24,000 psi	24,000 psi
Sp Insp	No	No
Grout Spacing	16 in	16 in

Analysis Data

	Pier #1	Pier #2
Height/Length	3.7647	2.2069
(H/L)^3	53.3572	10.7485
Rel. Defl	762.4269	443.2901
Sum Rigidity	3.57	
Rigidity = .001/Defl	1.312	2.256
% Force to Pier	0.37	0.63
Shear to Pier	19.909 k	34.241 k
Relative Defl * 10^5	76.24 in	44.33 in
M / (V*Depth)	3.765	2.207

Summary

	Pier #1	Pier #2
Shear Reinforcing...		
$f_v = V/(12 * \text{est} * d)$	91.38 psi	91.11 psi
Fv: w/o Reinf.	23.28 psi	23.28 psi
Fv: w/ Reinf.	38.63 psi	38.63 psi
Horiz. Shear Av Req'd	$f_v > F_v: \text{max}$	$f_v > F_v: \text{max}$ ✓. NO GOOD
Bending Reinforcing...		
Moment @ End	318.54 k-ft	547.86 k-ft
"d" to tension As	3.78 ft	6.52 ft
Bending As Req'd	1.00 in ²	1.00 in ²

▲▲ INTEGRATED DESIGN SERVICES, INC.
Structural Engineers

JOB NO. :

SHEET

OF

SUBJECT:

DESIGNED : RF

DATE : 5-31-00

CHECKED :

DATE :

CHECK STEARZ WALLS.

FLEXIBLE ROOF DIAPHRAGM.

N-S DIRECTION.

2ND FLOOR WALLS.

WEST WALL

$$68.22^k \div 2 \div (39.25 + 4'-7" + 6'-0" + 8'-0" + 4') =$$

551 plv

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 3:11PM, 31 MAY 00
Description : Collection of example problems

Scope : All programs in the Structural Engineering Library

Rev: 510002
User: EW-0602970, Ver 5.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Masonry Pier Analysis & Design

Page 1

c:\enercalc\examples.ecw:Masonry Calcs

Description Riverside Fire Station No. 1

END FLOOR WALLS - WEST WALL

General Information

Calculations are designed to 1997 UBC Requirements

Total Lateral Force	34.11 k	Moduli: Em = fm *	1,500.00
Seismic Zone	4	Moduli: Ev = fm *	0.40
Load Duration Factor	1.33		

Shear Pier Data

	Pier #1	Pier #2	Pier #3	Pier #4	Pier #5
Pier Height	11.25 ft				
Pier Length	39.25 ft	4.58 ft	6.00 ft	8.00 ft	4.00 ft
Wall Thickness	8 in				
"J" : Depth Mult.	0.89	0.90	0.90	0.90	0.00
Pier Fixity	Pin-Fix	Pin-Fix	Pin-Fix	Pin-Fix	Pin-Fix
fm	1,500 psi				
Fs	24,000 psi				
Sp Insp	No	No	No	No	No
Grout Spacing	24 in	16 in	16 in	16 in	16 in

Analysis Data

	Pier #1	Pier #2	Pier #3	Pier #4	Pier #5
Height/Length	0.2866	2.4563	1.8750	1.4063	2.8125
(H/L)^3	0.0235	14.8204	6.5918	2.7809	22.2473
Rel. Defl	71.6613	617.3764	470.2148	352.1805	708.0688
Sum Rigidity	21.95				
Rigidity = .001/Defl	13.955	1.620	2.127	2.839	1.412
% Force to Pier	0.64	0.07	0.10	0.13	0.06
Shear to Pier	21.682 k	2.517 k	3.304 k	4.412 k	2.194 k
Relative Defl * 10^5	0.00 in	61.74 in	47.02 in	35.22 in	70.81 in
M / (V*Depth)	0.287	2.456	1.875	1.406	2.813

Summary

	Pier #1	Pier #2	Pier #3	Pier #4	Pier #5
Shear Reinforcing...					
fv=V/(12*est*jd)	14.92 psi	13.16 psi	13.19 psi	13.21 psi	0.00 psi
Fv: w/o Reinf.	31.88 psi	23.28 psi	23.28 psi	23.28 psi	23.28 psi
Fv: w/ Reinf.	47.82 psi	38.63 psi	38.63 psi	38.63 psi	38.63 psi
Horiz. Shear Av Req'd	Not Req'd in^2/ft				
fv>Fv:max					
Bending Reinforcing...					
Moment @ End	243.93 k-ft	28.31 k-ft	37.17 k-ft	49.63 k-ft	24.69 k-ft
"d" to tension As	34.93 ft	4.12 ft	5.40 ft	7.20 ft	0.00 ft
Bending As Req'd	0.22 in ²	0.30 in ²	0.22 in ²	0.22 in ²	1.00 in ²

▲▲ INTEGRATED DESIGN SERVICES, INC.
Structural Engineers

JOB NO. :

SHEET

OF

SUBJECT:

DESIGNED : RF

DATE: 5-31-00

CHECKED :

DATE:

SHEAR WALL

2ND FLOOR E-W DIRECTION.

SOUTH WALL

$$68.22' - 2 \div 17'8'' + 3'-7'' + 3'-7'' + 2'-11'' \\ = 1229.5 \text{ sq ft}$$

SEE ATTACHED COMPUTER OUTPUT.

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 5:21PM, 31 MAY 00
Description : Collection of example problems

Scope : All programs in the Structural Engineering Library

Rev: S10002
User: KW-0602970, Ver 5.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Masonry Pier Analysis & Design

Page 1

c:\enercalc\examples.ecw:Masonry Calcs

Description Riverside Fire Station No. 1 2nd Floor-South Wall

General Information

Calculations are designed to 1997 UBC Requirements

Total Lateral Force	20.05 k	Moduli: Em = fm *	1,500.00
Seismic Zone	4	Moduli: Ev = fm *	0.40
Load Duration Factor	1.33		

Shear Pier Data

	Pier #1	Pier #2	Pier #3	Pier #4
Pier Height	12.25 ft	12.25 ft	12.25 ft	12.25 ft
Pier Length	17.66 ft	3.58 ft	3.58 ft	2.92 ft
Wall Thickness	8 in	8 in	8 in	8 in
"J" : Depth Mult.	0.89	0.90	0.90	0.90
Pier Fixity	Pin-Fix	Pin-Fix	Pin-Fix	Pin-Fix
f'm	1,500 psi	1,500 psi	1,500 psi	1,500 psi
Fs	24,000 psi	24,000 psi	24,000 psi	24,000 psi
Sp Insp	No	No	No	No
Grout Spacing	24 in	24 in	24 in	24 in

Analysis Data

	Pier #1	Pier #2	Pier #3	Pier #4
Height/Length	0.6937	3.4218	3.4218	4.2010
(H/L)^3	0.3338	40.0645	40.0845	74.1388
Rel. Defl	173.4887	864.3501	864.3501	1066.7153
Sum Rigidity	9.02			
Rigidity = .001/Defl	5.764	1.157	1.157	0.937
% Force to Pier	0.64	0.13	0.13	0.10
Shear to Pier	12.819 k	2.573 k	2.573 k	2.085 k
Relative Defl * 10^5	17.35 in	86.44 in	86.44 in	106.67 in
M / (V*Depth)	0.694	3.422	3.422	4.201

Summary

	Pier #1	Pier #2	Pier #3	Pier #4
Shear Reinforcing...				
fv=V/(12*est*jd)	19.61 psi	19.20 psi	19.20 psi	19.10 psi
Fv: w/o Reinf.	28.39 psi	23.28 psi	23.28 psi	23.28 psi
Fv: w/ Reinf.	42.58 psi	38.63 psi	38.63 psi	38.63 psi
Horiz. Shear Av Req'd	Not Req'd in^2/ft	Not Req'd in^2/ft	Not Req'd in^2/ft	Not Req'd in^2/ft
				OK
Bending Reinforcing...				
Moment @ End	157.03 k-ft	31.52 k-ft	31.52 k-ft	25.54 k-ft
"d" to tension As	15.72 ft	3.22 ft	3.22 ft	2.62 ft
Bending As Req'd	0.31 in2	1.25 in2	1.25 in2	1.86 in2

▲▲ INTEGRATED DESIGN SERVICES, INC.
Structural Engineers

JOB NO. :

SHEET

OF

SUBJECT:

DESIGNED:

DATE:

CHECKED:

DATE:

SHEAR WALLS

2ND FLOOR: E-W DIRECTION.

NORTH WALL.

NO APPARENT SHEAR RESISTING ELEMENTS.

"8" METAL STUDS W/ PLASTER. :- NO GOOD

→ ADD SHEAR
RESISTING ELEMENTS.
ALTERNATIVES

1. STEEL WELDED
MOMENT FRAME.

2. STEEL BRACED
FRAME.

3. NEW PLYWOOD SHEAR
WALL- ROOF TO
TOP OF 2ND FLOOR
SLAB AT 16'
SOUTH OF (E)
NORTH 2ND FLOOR
CANTILEVERED
WALL.

▲▲ INTEGRATED DESIGN SERVICES, INC.
Structural Engineers

JOB NO. :

SHEET

OF

SUBJECT:

DESIGNED : RF

DATE : 5-31-00

CHECKED :

DATE :

SHEAR WALL.

2ND FLOOR - N-S DIRECTION

EAST WALL - DORM AREA.

$$68.22^E + 2 + 9.5' + 9' + 9.5' + 6.5' + 4' + 5' = 184 \text{ plf}$$

(E) METAL STUDS W/PLASTER

! No Good

**ADD NEW SHEAR
WALLS.**

APPARATUS ROOM - EAST WALL

$$40.09^E - 2 = 20.05^E + 29.3' + 71' = 128.6 \text{ plf}$$

SEE ATTACHED COMPUTER OUTPUT.

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 9:23AM, 1 JUN 00
Description : Collection of example problems

Scope : All programs in the Structural Engineering Library

Rev: S10002
User: KM-0602970, Ver 5.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Rigid Diaphragm Torsional Analysis

Page 1

C:\enercalc\examples.ecw\Analysis Calcs

Description Riverside Fire Station No. 1-Second Floor

General Information

Y-Y Axis Shear	160.80 k	Min. X Axis Ecc	5.00 %	X Axis Center of Mass	0.00 ft
X-X Axis Shear	160.80 k	Min. Y Axis Ecc	5.00 %	Y Axis Center of Mass	0.00 ft
...Shears are applied on each axis separately				Max X Dimension	56.33 ft
				Max Y Dimension	112.16 ft

Wall Data

Label	Thickness	Length	Height	Wall Xcg	Wall Ycg	Wall Angle	Wall End	E
	In	ft	ft	ft	ft	deg CCW	Fixity	
1	11.000	3.330	11.660	-9.830	56.000	0.0	Fix-Fix	3.1
✓ 2	11.000	8.000	11.660	-1.170	56.000	0.0	Fix-Fix	3.1
3	11.000	3.583	11.660	10.950	56.000	0.0	Fix-Fix	3.1
✓ 4	11.000	19.583	11.660	35.000	56.000	0.0	Fix-Fix	3.1
5	11.000	15.250	11.660	44.750	48.000	90.0	Fix-Fix	3.1
6	11.000	3.580	11.660	44.750	36.000	90.0	Fix-Fix	3.1
7	11.000	1.580	11.660	44.750	27.700	90.0	Fix-Fix	3.1
8	11.000	3.580	11.660	44.750	19.140	90.0	Fix-Fix	3.1
9	9.000	3.660	11.660	42.900	17.000	0.0	Fix-Fix	3.1
10	11.000	3.330	11.660	41.000	17.000	90.0	Fix-Fix	3.1
11	11.000	7.580	11.660	41.000	-2.120	90.0	Fix-Fix	3.1
12	11.000	8.580	11.660	41.000	-22.200	90.0	Fix-Fix	3.1
13	11.000	4.000	11.660	41.000	-32.200	90.0	Fix-Fix	3.1
14	11.000	24.580	11.660	28.710	-56.000	0.0	Fix-Fix	3.1
15	11.000	4.580	11.660	7.840	-56.000	0.0	Fix-Fix	3.1
16	11.000	5.580	11.660	-8.750	-56.000	0.0	Fix-Fix	3.1
17	10.000	2.580	11.660	-11.500	-51.400	90.0	Fix-Fix	3.1
✓ 18	10.000	32.000	11.660	-11.500	-30.000	90.0	Fix-Fix	3.1
19	10.000	12.250	11.660	-11.500	-5.000	90.0	Fix-Fix	3.1
20	10.000	5.250	11.660	-11.500	6.700	90.0	Fix-Fix	3.1
21	10.000	4.080	11.660	-11.500	38.000	90.0	Fix-Fix	3.1
22	10.000	1.250	11.660	-11.500	44.400	90.0	Fix-Fix	3.1
23	10.000	7.330	11.660	-11.500	52.400	90.0	Fix-Fix	3.1

Calculated Wall Forces

Label	Load Location for Maximum Forces			Direct Shears k		Torsional Shears k		Final Max. Wall Shear k
	X	ft	Y	Length	Width	Length	Width	
1	0.000	8.481		-1.856	0.000	-0.235	0.007	-2.091
2	0.000	8.481		-13.964	0.000	-1.787	0.009	-15.731
3	0.000	8.481		-2.252	0.000	-0.285	-0.001	-2.537
4	0.000	8.481		-54.385	0.000	-6.882	-0.056	-61.267
5	-11.652	0.000		29.701	0.000	-4.171	-0.116	29.701
6	-11.652	0.000		1.697	0.000	-0.238	-0.021	1.697
7	-11.652	0.000		0.173	0.000	-0.024	-0.007	0.173
8	-11.652	0.000		1.685	0.000	-0.237	-0.012	1.685
9	0.000	8.481		-1.933	0.000	-0.083	-0.007	-2.016
10	-11.652	0.000		1.394	0.000	-0.175	-0.010	1.394
11	-11.652	0.000		9.442	0.000	-1.188	-0.001	9.442
✓ 12	-11.652	0.000		11.925	0.000	-1.500	0.025	11.925
13	-11.652	0.000		2.240	0.000	-0.282	0.017	2.240
✓ 14	0.000	-2.735		-70.845	0.000	-2.609	0.017	-73.454

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 9:23AM, 1 JUN 00
Description : Collection of example problems
Scope : All programs in the Structural Engineering Library

Rev: 510002
User: KW-0602970, Ver 3.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Rigid Diaphragm Torsional Analysis

Page 2

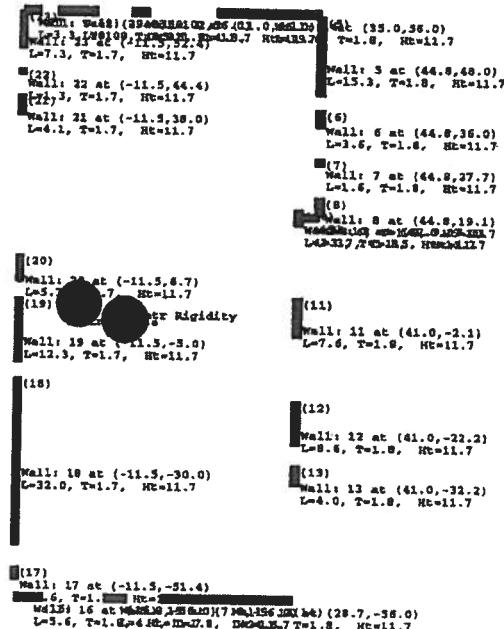
Description Riverside Fire Station No. 1-Second Floor

15	0.000	-2.735	-4.146	0.000	-0.153	-0.000	-4.299
16	0.000	-2.735	-6.576	0.000	-0.242	-0.003	-6.819
17	-11.652	0.000	0.634	0.000	0.050	0.014	0.685
18	-11.652	0.000	65.427	0.000	5.203	0.097	70.829
19	-11.652	0.000	19.585	0.000	1.557	0.003	21.142
20	-11.652	0.000	3.930	0.000	0.313	-0.006	4.243
21	-11.652	0.000	2.140	0.000	0.170	-0.019	2.310
22	-11.652	0.000	0.079	0.000	0.008	-0.007	0.085
23	-11.652	0.000	8.037	0.000	0.639	-0.045	8.676

Summary

X Distance to Center of Rigidity	8.836 ft	Controlling Eccentricities & Forces from Applied Y-Y Shear
Y Distance to Center of Rigidity	-2.873 ft	Xcm + .05*Max-X - X-cr = -6.019 ft Torsion = -967.90 k-ft Xcm - .05*Max-X - X-cr = -11.652 ft Torsion = -1,873.68 k-ft
X Accidental Eccentricity	2.817 ft	Controlling Eccentricities & Forces from Applied X-X Shear
Y Accidental Eccentricity	5.608 ft	Ycm + .05*Max-Y - Y-cr = 8.481 ft Torsion = 1,363.72 k-ft Ycm - .05*Max-Y - Y-cr = -2.735 ft Torsion = -439.81 k-ft

Sketch & Diagram



Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 9:28AM, 1 JUN 00
Description : Collection of example problems
Scope : All programs in the Structural Engineering Library

Rev: 510002
User: KW-0602970, Ver 5.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Masonry Pier Analysis & Design

Page 1

c:\enercalc\examples.ecw:Masonry Calcs

Description Riverside Fire Station No. 1 First floor Wall No. 2

General Information

Calculations are designed to 1997 UBC Requirements		
Total Lateral Force	15.70 k	Moduli: Em = f'm * 1,500.00
Seismic Zone	4	Moduli: Ev = f'm * 0.40
Load Duration Factor	1.33	

Shear Pier Data

Pier #1

Pier Height	11.66 ft
Pier Length	8.00 ft
Wall Thickness	10 in
"I" : Depth Mult.	0.89
Pier Fixity	Fix-Fix
f'm	1,500 psi
Fs	24,000 psi
Sp Insp	No
Grout Spacing	16 in

Analysis Data

Pier #1

Height/Length	1.4575
(H/L)^3	3.0962
Rel. Defl	291.6376
Sum Rigidity	3.43
Rigidity = .001/Defl	3.429
% Force to Pier	1.00
Shear to Pier	15.700 k
Relative Defl * 10^5	29.16 in
M / (V*Depth)	0.729

Summary

Shear Reinforcing...

$f_v = V/(12 * est * d)$	Pier #1
Fv: w/o Reinf.	38.28 psi
Fv: w/ Reinf.	28.08 psi
Horiz. Shear Av Req'd	42.13 psi

Pier #1

$f_v = V/(12 * est * d)$	Pier #1
Fv: w/o Reinf.	38.28 psi
Fv: w/ Reinf.	28.08 psi
Horiz. Shear Av Req'd	42.13 psi

(act #4 e 16", 147 in²/ft.: OK)

Bending Reinforcing...

Moment @ End	91.53 k-ft
"d" to tension As	7.12 ft
Bending As Req'd	0.47 in ²

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 9:30AM, 1 JUN 00
Description : Collection of example problems
Scope : All programs in the Structural Engineering Library

Rev: 510002
User: KW-0602970, Ver 5.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Masonry Pier Analysis & Design

Page 1

Description Riverside Fire Station No. 1 First floor Wall No. 4

General Information

Calculations are designed to 1997 UBC Requirements

Total Lateral Force	61.27 k	Moduli: Em = fm * 1,500.00
Seismic Zone	4	Moduli: Ev = fm * 0.40
Load Duration Factor	1.33	

Shear Pier Data

Pier #1

Pier Height	11.66 ft
Pier Length	19.58 ft
Wall Thickness	10 in
"j" : Depth Mult.	0.89
Pier Fixity	Fix-Fix
f'm	1,500 psi
Fs	24,000 psi
Sp Insp	No
Grout Spacing	16 in

Analysis Data

Pier #1

Height/Length	0.5955
(H/L)^3	0.2112
Rel. Defl	119.1105
Sum Rigidity	8.40
Rigidity = .001/Defl	8.396
% Force to Pier	1.00
Shear to Pier	61.270 k
Relative Defl * 10^5	11.91 in
M / (V*Depth)	0.298

Summary

Pier #1

Shear Reinforcing...	
$f_v = V / (12 * est * d)$	61.04 psi
Fv: w/o Reinf.	31.78 psi
Fv: w/ Reinf.	47.68 psi
Horiz. Shear Av Req'd	$f_v > F_v : \text{max}$

∴ NO. GOOD.

Bending Reinforcing...

Moment @ End	357.20 k-ft
"d" to tension As	17.43 ft
Bending As Req'd	0.64 in ²

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 9:32AM, 1 JUN 00
Description : Collection of example problems

Scope : All programs in the Structural Engineering Library

Rev: 510002
User: KW-0602970, Ver 5.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Masonry Pier Analysis & Design

Page 1

c:\enercalc\examples.ecw:Masonry Calcs

Description Riverside Fire Station No. 1 First floor Wall No. 12

General Information

	Calculations are designed to 1997 UBC Requirements	
Total Lateral Force	11.90 k	Moduli: Em = fm * 1,500.00
Seismic Zone	4	Moduli: Ev = fm * 0.40
Load Duration Factor	1.33	

Shear Pier Data

	Pier #1
Pier Height	11.66 ft
Pier Length	8.58 ft
Wall Thickness	10 in
"J" : Depth Mult.	0.89
Pier Fixity	Fix-Fix
fm	1,500 psi
Fs	24,000 psi
Sp Insp	No
Grout Spacing	16 in

Analysis Data

	Pier #1
Height/Length	1.3590
(H/L)^3	2.5098
Rel. Defl	271.9064
Sum Rigidity	3.68
Rigidity = .001/Defl	3.678
% Force to Pier	1.00
Shear to Pier	11.900 k
Relative Defl * 10^5	27.19 in
M / (V*Depth)	0.679

Summary

	Pier #1	/
Shear Reinforcing...		
$f_v = V/(12 * \text{est} * d)$	27.05 psi	
Fv: w/o Reinf.	28.51 psi	
Fv: w/ Reinf.	42.76 psi	
Horiz. Shear Av Req'd	Not Req'd in^2/ft	<i>s. OK.</i>

Bending Reinforcing...

Moment @ End	69.38 k-ft
"d" to tension As	7.64 ft
Bending As Req'd	0.28 in2

Integrated Design Services, Inc
 250 N. Golden Circle Drive
 Suite 105
 Santa Ana, California 92705
 (714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
 Dsgnr: MDB Date: 9:34AM, 1 JUN 00
 Description : Collection of example problems
 Scope : All programs in the Structural Engineering Library

Rev: S10002
 User: KW-0602970, Ver 5.1.2, 13-Jun-1999, Win32
 (c) 1983-99 ENERCALC

Masonry Pier Analysis & Design

Page 1

c:\enercalc\examples.ecw:Masonry Calcs

Description Riverside Fire Station No. 1 First floor Wall No. 14

General Information

Calculations are designed to 1997 UBC Requirements

Total Lateral Force	73.45 k	Moduli: Em = fm * 1,500.00
Seismic Zone	4	Moduli: Ev = fm * 0.40
Load Duration Factor	1.33	

Shear Pier Data

Pier #1

Pier Height	11.66 ft
Pier Length	24.58 ft
Wall Thickness	10 in
"J" : Depth Mult.	0.89
Pier Fixity	Fix-Fix
f'm	1,500 psi
Fs	24,000 psi
Sp Insp	No
Grout Spacing	16 in

Analysis Data

Pier #1

Height/Length	0.4744
(H/L)^3	0.1067
Rel. Defl	94.8786
Sum Rigidity	10.54
Rigidity = .001/Defl	10.540
% Force to Pier	1.00
Shear to Pier	73.450 k
Relative Defl * 10^5	0.00 in
M / (V*Depth)	0.237

Summary

Shear Reinforcing...

Pier #1	
$f_v = V/(12 \cdot e_{st} \cdot j_d)$	58.29 psi
Fv: w/o Reinf.	32.30 psi
Fv: w/ Reinf.	48.46 psi
Horiz. Shear Av Req'd	$f_v > F_v: \text{max}$, No Good

Bending Reinforcing...

Moment @ End	428.21 k-ft
"d" to tension As	21.88 ft
Bending As Req'd	0.61 in ²

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 9:36AM, 1 JUN 00
Description : Collection of example problems
Scope : All programs in the Structural Engineering Library

Rev: 510002
User: KM-0602970, Ver 5.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Masonry Pier Analysis & Design

Page 1

c:\enercalc\examples.ecw:Masonry Calcs

Description Riverside Fire Station No. 1 First floor Wall No.18

General Information

	Calculations are designed to 1997 UBC Requirements	
Total Lateral Force	70.63 k	Moduli: Em = fm * 1,500.00
Seismic Zone	4	Moduli: Ev = fm * 0.40
Load Duration Factor	1.33	

Shear Pier Data

	Pier #1
Pier Height	11.66 ft
Pier Length	32.00 ft
Wall Thickness	10 in
T : Depth Mult.	0.89
Pier Fixity	Fix-Fix
f'm	1,500 psi
Fs	24,000 psi
Sp Insp	No
Grout Spacing	16 in

Analysis Data

	Pier #1
Height/Length	0.3644
(H/L)^3	0.0484
Rel. Defl	72.8772
Sum Rigidity	13.72
Rigidity = .001/Defl	13.722
% Force to Pier	1.00
Shear to Pier	70.630 k
Relative Defl * 10^5	0.00 in
M / (V*Depth)	0.182

Summary

Shear Reinforcing...

	Pier #1
$f_v = V/(12 * est * d)$	43.06 psi
Fv: w/o Reinf.	32.78 psi
Fv: w/ Reinf.	49.16 psi
Horiz. Shear Av Req'd	0.104 in^2/ft <i>(Act #4 Horiz. Elas' .13 in^2/ft. OK)</i>

Bending Reinforcing...

Moment @ End	411.77 k-ft
"d" to tension As	28.48 ft
Bending As Req'd	0.45 in^2

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Rev: 510002
User: KN-0602970, Ver 5.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 10:16AM, 1 JUN 00
Description : Collection of example problems
Scope : All programs in the Structural Engineering Library

Concrete Shear Wall Design

Page 1

c:\enercalc\examples.ecw:Concrete Calcs

Description Riverside Fire Station No. 1-Wall 2
EXISTING

General Information

Calculations are designed to ACI 318-95 and 1997 UBC Requirements

Total Wall Height	24.000 ft	Seismic Factor	0.306
Concrete Weight	100.000 pcf	Seismic Zone	4
Live & Short Term Load Combined		Min Wall As% for Bending	0.0030
		Overburden Weight	0.00 psf

Applied Loads

Short Term Lateral Loads...		Vertical Loads...		Live	Short Term	Vertical	Horiz.
Load	Height	Dead	k				
#1 9.800 k	23.000 ft	#1 1.500				23.000	4.000 ft
#2 15.700 k	11.660 ft	#2 3.600				11.660	4.000 ft

Wall Data

	<u>Bottom</u>	<u>2nd Level</u>
Analysis Height	0.00 ft	11.660 ft
Wall Offset	(datum) ft	ft
Wall Length	8.000 ft	8.000 ft
Wall Thickness	10.000 in	9.000 in
f'c : Concrete	2,000.0 psi	2,000.0 psi
Fy : Rebar	60,000.0 psi	60,000.0 psi
Effective Depth	4.800 ft	4.800 ft

Wall Analysis

	<u>Bottom</u>	<u>2nd Level</u>
Vs : Story Shear	27.88 k	12.07 k
Ms w/ Lat Right	462.7 k-ft	125.1 k-ft
Ms w/ Lat Left	462.7 k-ft	-125.1 k-ft
Uplift @ Left End	47.70 k	9.39 k
Uplift @ Right	47.70 k	9.39 k
Vu = Vs * Factor(s)	42.202 k	16.892 k
Vu : Applied	61.98 psi	26.47 psi
Nu : Axial	28.39 k	12.47 k
Mu : Moment	647.82 k-ft	175.16 k-ft
vc * .85	59.842 psi	85.571 psi
vn:max = 1k	268.33 psi	268.33 psi
		psi
		psi
		psi

Summary

	<u>Bottom</u>	<u>2nd Level</u>
Vu	42.20 k	16.89 k
Horizontal As Req'd	0.30 in ²	0.22 in ²
Vertical As Req'd	0.30 in ²	0.13 in ²
Mu : Actual	647.82 k-ft	175.16 k-ft
Bending As Req'd	2.73 in ²	1.56 in ²

Footing

f'c	2,500.0 psi
Fy	60,000.0 psi
Rebar Cover	3.000 in
Footing Thickness	8.00 in
Width	2.080 ft

Footing Dimensions

Dist. Left	1.500 ft
Wall Length	8.000 ft
Dist. Right	3.000 ft
Total Ftg Length	12.500 ft
Kern Width	2.083 ft

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 10:16AM, 1 JUN 00
Description : Collection of example problems
Scope : All programs in the Structural Engineering Library

Rev: 510002
User: KM-0602970, Ver 5.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Concrete Shear Wall Design

Page 2

c:\enercalc\examples.ecw:Concrete Calcs

Description Riverside Fire Station No. 1-Wall 2

Wall & Footing Stability...

	<u>Service Loads</u>	<u>ACI Eq. 9-1</u>	<u>ACI Eq. 9-2 & 9-3</u>
Total Vertical Loads	22.01 k	30.81 k	30.81 k
Overturning Moments...			
No Lateral or Short Term Loads	15.21 k-ft	21.29 k-ft	
Lat & ST Loads Applied to Left	498.03 k-ft		697.24 k-ft
Lat & ST Loads Applied to Right	467.61 k-ft		654.66 k-ft
Resultant Ecc. from Centerline...			
No Lateral or Short Term Loads	-0.691 ft	-0.691 ft	
Lat & ST Loads Applied to Left	-22.627 ft		-22.627 ft
Lat & ST Loads Applied to Right	21.245 ft		21.245 ft

Overall Wall & Footing Stability

Overspinning Stability	<u>Overspinning Moment</u>	<u>Resisting Moment</u>	<u>Stability Ratio</u>
Lateral Loads Applied to Left	428.45 k-ft	122.36 k-ft	0.286 : 1
Lateral Loads Applied to Right	428.45 k-ft	152.77 k-ft	0.357 : 1
One-Way Shear Check			<i>No Gc Footing.</i>
@ Left End of Footing	32.801 psi	Allowable	85.000 psi
@ Right End of Footing	44.239 psi		
Bending Design	<u>M_u</u>	<u>R_u</u>	<u>As % Req'd</u>
@ Left End of Footing	3.62 k-ft	77.34 psi	0.0017
@ Right End of Footing	8.00 k-ft	171.00 psi	0.0033
Min. As % =	0.0014		0.218 in ²
			0.416 in ²

Soil Pressures

Soil Pressures	<u>Service</u>	<u>ACI Eq. 9-1</u>
Static Soil Pressure @ Left	1,127.33	1,578.26 psf
Static Soil Pressure @ Right	565.80	792.12 psf
Soil Pressures w/ Short Term Load Applied To Left		
@ Left Side of Footing	0.00 psf	0.00 psf
@ Right Side of Footing	0.00 psf	0.00 psf
Soil Pressures w/ Short Term Load Applied To Right		
@ Left Side of Footing	0.00 psf	0.00 psf
@ Right Side of Footing	0.00 psf	0.00 psf

ACI Factors (per ACI, applied internally to entered loads)

ACI 9-1 & 9-2 DL	1.400	ACI 9-2 Group Factor	0.750	UBC 1921.2.7 "1.4" Factor	1.400
ACI 9-1 & 9-2 LL	1.700	ACI 9-3 Dead Load Factor	0.900	UBC 1921.2.7 "0.9" Factor	0.900
ACI 9-1 & 9-2 ST	1.700	ACI 9-3 Short Term Factor	1.300		
....seismic = ST * :	1.100				

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 10:23AM, 1 JUN 00
Description : Collection of example problems

Scope : All programs in the Structural Engineering Library

Rev: 510002
User: RW-0602970, Ver 5.1.2, 13-Jun-1999, Win95
(c) 1983-99 ENERCALC

Concrete Shear Wall Design

Page 1

C:\enercalc\examples.ecw:Concrete Calcs

Description Riverside Fire Station No. 1-Wall 2

REQUERED

General Information

Calculations are designed to ACI 318-95 and 1997 UBC Requirements

Total Wall Height	24.000 ft	Seismic Factor	0.306
Concrete Weight	100.000 pcf	Seismic Zone	4
Live & Short Term Load Combined		Min Wall As% for Bending	0.0030
		Overburden Weight	0.00 psf

Applied Loads

Short Term Lateral Loads...		Vertical Loads...		Dead	Live	Short Term	Vertical	Horiz.
Load	Height	#1	1.500					
#1 9.800 k	23.000 ft	#1	1.500					
#2 15.700 k	11.660 ft	#2	3.600					

Wall Data

	<u>Bottom</u>	<u>2nd Level</u>
Analysis Height	0.00 ft	11.660 ft
Wall Offset	(datum) ft	ft
Wall Length	8.000 ft	8.000 ft
Wall Thickness	10.000 in	9.000 in
f'c : Concrete	2,000.0 psi	2,000.0 psi
Fy : Rebar	60,000.0 psi	60,000.0 psi
Effective Depth	4.800 ft	4.800 ft

Wall Analysis

	<u>Bottom</u>	<u>2nd Level</u>
Vs : Story Shear	27.88 k	12.07 k
Ms w/ Lat Right	462.7 k-ft	125.1 k-ft
Ms w/ Lat Left	462.7 k-ft	-125.1 k-ft
Uplift @ Left End	47.70 k	9.39 k
Uplift @ Right	47.70 k	9.39 k
Vu = Vs * Factor(s)	42.202 k	16.892 k
Vu : Applied	61.98 psi	26.47 psi
Nu : Axial	28.39 k	12.47 k
Mu : Moment	647.82 k-ft	175.16 k-ft
vc * .85	59.842 psi	85.571 psi
vn:max = 1t	268.33 psi	268.33 psi
		psi
		psi
		psi

Summary

	<u>Bottom</u>	<u>2nd Level</u>
Vu	42.20 k	16.89 k
Horizontal As Req'd	0.30 in ²	0.22 in ²
Vertical As Req'd	0.30 in ²	0.13 in ²
Mu : Actual	647.82 k-ft	175.16 k-ft
Bending As Req'd	2.73 in ²	1.56 in ²

Footing

f'c 2,500.0 psi
Fy 60,000.0 psi

Rebar Cover 3.000 in
Footing Thickness 24.00 in
Width 6.000 ft

Footing Dimensions

Dist. Left	6.500 ft
Wall Length	8.000 ft
Dist. Right	6.500 ft
Total Ftg Length	21.000 ft
Kern Width	3.500 ft

ADD FOOTING WIDTH + T.H.

Integrated Design Services, Inc
 250 N. Golden Circle Drive
 Suite 105
 Santa Ana, California 92705
 (714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
 Dsgnr: MDB Date: 10:23AM, 1 JUN 00
 Description : Collection of example problems

Scope : All programs in the Structural Engineering Library

Rev: 510002
 User: KW-0602970, Ver 5.1.2, 13-Jun-1999, Win32
 (c) 1983-99 ENERCALC

Concrete Shear Wall Design

Page 2

c:\enercalc\examples.ecw:Concrete Calcs

Description Riverside Fire Station No. 1-Wall 2

Wall & Footing Stability...

	<u>Service Loads</u>	<u>ACI Eq. 9-1</u>	<u>ACI Eq. 9-2 & 9-3</u>
Total Vertical Loads	45.48 k	63.67 k	63.67 k
Overturning Moments...			
No Lateral or Short Term Loads	0.00 k-ft	0.00 k-ft	
Lat & ST Loads Applied to Left	523.01 k-ft		732.22 k-ft
Lat & ST Loads Applied to Right	523.01 k-ft		732.22 k-ft
Resultant Ecc. Fom Centerline...			
No Lateral or Short Term Loads	0.000 ft	0.000 ft	
Lat & ST Loads Applied to Left	-11.501 ft		-11.501 ft
Lat & ST Loads Applied to Right	11.501 ft		11.501 ft

Overall Wall & Footing Stability

<u>Overturning Stability</u>	<u>Overturning Moment</u>	<u>Resisting Moment</u>	<u>Stability Ratio</u>
Lateral Loads Applied to Left	468.64 k-ft	477.51 k-ft	1.019 : 1
Lateral Loads Applied to Right	468.64 k-ft	477.51 k-ft	1.019 : 1
One-Way Shear Check			
@ Left End of Footing	11.205 psi	Allowable	85.000 psi
@ Right End of Footing	11.205 psi		
Bending Design	<u>M_u</u>	<u>R_u</u>	<u>As % Req'd</u>
@ Left End of Footing	64.05 k-ft	26.89 psi	0.0014
@ Right End of Footing	64.05 k-ft	26.89 psi	0.0014
Min. As % =	0.0014		<u>As Req'd</u>
			2.117 in ²
			2.117 in ²

Soil Pressures

<u>Soil Pressures</u>	<u>Service</u>	<u>ACI Eq. 9-1</u>
Static Soil Pressure @ Left	360.93	505.30 psf
Static Soil Pressure @ Right	360.93	505.30 psf
Soil Pressures w/ Short Term Load Applied To Left	<u>Service</u>	<u>ACI Eq. 9-2 & 9-3</u>
@ Left Side of Footing	0.00 psf	0.00 psf
@ Right Side of Footing	0.00 psf	0.00 psf
Soil Pressures w/ Short Term Load Applied To Right	<u>Service</u>	<u>ACI Eq. 9-2 & 9-3</u>
@ Left Side of Footing	0.00 psf	0.00 psf
@ Right Side of Footing	0.00 psf	0.00 psf

ACI Factors (per ACI, applied internally to entered loads)

ACI 9-1 & 9-2 DL	1.400	ACI 9-2 Group Factor	0.750	UBC 1921.2.7 "1.4" Factor	1.400
ACI 9-1 & 9-2 LL	1.700	ACI 9-3 Dead Load Factor	0.900	UBC 1921.2.7 "0.9" Factor	0.900
ACI 9-1 & 9-2 ST	1.700	ACI 9-3 Short Term Factor	1.300		
....seismic = ST * :	1.100				

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 11:06AM, 1 JUN 00
Description : Collection of example problems
Scope : All programs in the Structural Engineering Library

Rev: 510002
User: RW-0602970, Ver 5.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Concrete Shear Wall Design

Page 1

c:\enercalc\examples.ecw:Concrete Calcs

Description Riverside Fire Station No. 1-Wall 4

EXISTING

General Information

Calculations are designed to ACI 318-95 and 1997 UBC Requirements

Total Wall Height	11.660 ft	Seismic Factor	0.306
Concrete Weight	100.000 pcf	Seismic Zone	4
Live & Short Term Load Combined		Min Wall As% for Bending	0.0030
		Overburden Weight	0.00 psf

Applied Loads

Short Term Lateral Loads...

<u>Load</u>	<u>Height</u>	<u>Dead</u>	<u>Live</u>	<u>Short Term</u>	<u>Vertical</u>	<u>Horiz.</u>
#1 61.270 k	11.500 ft	#1 3.700		k	11.660	9.700 ft

Wall Data

Bottom

Analysis Height	0.00 ft
Wall Offset (datum)	ft
Wall Length	19.580 ft
Wall Thickness	11.000 in
F _c : Concrete	2,000.0 psi
F _y : Rebar	60,000.0 psi
Effective Depth	4.800 ft

Wall Analysis

Bottom

V _s : Story Shear	67.87 k			
M _s w/ Lat Right	741.6 k-ft			
M _s w/ Lat Left	741.6 k-ft			
Uplift @ Left End	25.56 k			
Uplift @ Right	25.60 k			
V _u = V _s * Factor(s)	94.743 k			
V _u : Applied	135.38 psi			
N _u : Axial	34.48 k			
M _u : Moment	1,039.18 k-ft			
v _c * .85	128.278 psi	psi		
v _n :max = 1k	268.33 psi		psi	psi

Summary

Bottom

V _u	94.74 k
Horizontal As Req'd	0.33 in ²
Vertical As Req'd	0.33 in ²
M _u : Actual	1,039.18 k-ft
Bending As Req'd	4.60 in ²

Footing

f _c	2,500.0 psi
F _y	60,000.0 psi
Rebar Cover	3.000 in
Footing Thickness	8.00 in
Width	2.100 ft

Footing Dimensions

Dist. Left	3.160 ft
Wall Length	19.580 ft
Dist. Right	0.750 ft
Total Ftg Length	23.490 ft
Kem Width	3.915 ft

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 11:06AM, 1 JUN 00
Description : Collection of example problems
Scope : All programs in the Structural Engineering Library

Rev: 510002
User: KN-0602970, Ver 5.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Concrete Shear Wall Design

Page 2

c:\enercalc\examples.ecw:Concrete Calcs

Description Riverside Fire Station No. 1-Wall 4

Wall & Footing Stability...

	<u>Service Loads</u>	<u>ACI Eq. 9-1</u>	<u>ACI Eq. 9-2 & 9-3</u>
Total Vertical Loads	27.92 k	39.08 k	39.08 k
Overturning Moments...			
No Lateral or Short Term Loads	29.34 k-ft	41.08 k-ft	
Lat & ST Loads Applied to Left	757.71 k-ft		1,060.80 k-ft
Lat & ST Loads Applied to Right	816.40 k-ft		1,142.96 k-ft
Resultant Ecc. from Centerline...			
No Lateral or Short Term Loads	1.051 ft	1.051 ft	
Lat & ST Loads Applied to Left	-27.142 ft		-27.142 ft
Lat & ST Loads Applied to Right	29.244 ft		29.244 ft

Overall Wall & Footing Stability

Overspinning Stability	<u>Overspinning Moment</u>	<u>Resisting Moment</u>	<u>Stability Ratio</u>
Lateral Loads Applied to Left	787.06 k-ft	357.22 k-ft	0.454 : 1
Lateral Loads Applied to Right	787.06 k-ft	298.53 k-ft	0.379 : 1
One-Way Shear Check			
@ Left End of Footing	32.512 psi	Allowable	85.000 psi
@ Right End of Footing	6.549 psi		
Bending Design	<u>M_u</u>	<u>R_u</u>	<u>As % Req'd</u>
@ Left End of Footing	6.28 k-ft	132.84 psi	0.0030
@ Right End of Footing	0.61 k-ft	12.87 psi	0.0014
Min. As % =	0.0014		0.383 in ²
			0.176 in ²

Soil Pressures

Soil Pressures	<u>Service</u>	<u>ACI Eq. 9-1</u>
Static Soil Pressure @ Left	413.98	579.57 psf
Static Soil Pressure @ Right	717.86	1,005.01 psf
Soil Pressures w/ Short Term Load Applied To Left	<u>Service</u>	<u>ACI Eq. 9-2 & 9-3</u>
@ Left Side of Footing	0.00 psf	0.00 psf
@ Right Side of Footing	0.00 psf	0.00 psf
Soil Pressures w/ Short Term Load Applied To Right	<u>Service</u>	<u>ACI Eq. 9-2 & 9-3</u>
@ Left Side of Footing	0.00 psf	0.00 psf
@ Right Side of Footing	0.00 psf	0.00 psf

ACI Factors (per ACI, applied internally to entered loads)

ACI 9-1 & 9-2 DL	1.400	ACI 9-2 Group Factor	0.750	UBC 1921.2.7 "1.4" Factor	1.400
ACI 9-1 & 9-2 LL	1.700	ACI 9-3 Dead Load Factor	0.900	UBC 1921.2.7 "0.9" Factor	0.900
ACI 9-1 & 9-2 ST	1.700	ACI 9-3 Short Term Factor	1.300		
....seismic = ST * :	1.100				

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 11:09AM, 1 JUN 00
Description : Collection of example problems

Scope : All programs in the Structural Engineering Library

Rev: 510002
User: KW-0502970, Ver 5.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Concrete Shear Wall Design

Page 1

c:\enercalc\examples.ecw:Concrete Calcs

Description Riverside Fire Station No. 1-Wall 4

REMOVED.

General Information

Calculations are designed to ACI 318-95 and 1997 UBC Requirements

Total Wall Height 11.660 ft
Concrete Weight 100.000 psf
Live & Short Term Load Combined

Seismic Factor 0.306
Seismic Zone 4
Min Wall As% for Bending 0.0030
Overburden Weight 0.00 psf

Applied Loads

Short Term Lateral Loads...

	Load	Height	Vertical Loads...	Dead	Live	Short Term	Vertical	Horiz.	
#1	61.270 k	11.500 ft	#1	3.700			k	11.660	9.700 ft

Wall Data

	Bottom
Analysis Height	0.00 ft
Wall Offset	(datum) ft
Wall Length	19.580 ft
Wall Thickness	11.000 in
fc : Concrete	2,000.0 psi
Fy : Rebar	60,000.0 psi
Effective Depth	4.800 ft

Wall Analysis

	Bottom			
Vs : Story Shear	67.67 k			
Ms w/ Lat Right	741.6 k-ft			
Ms w/ Lat Left	741.6 k-ft			
Uplift @ Left End	25.56 k			
Uplift @ Right	25.80 k			
Vu = Vs * Factor(s)	94.743 k			
Vu : Applied	135.38 psi			
Nu : Axial	34.48 k			
Mu : Moment	1,039.18 k-ft			
vc * .85	128.278 psi	psi		
vn:max = 1(268.33 psi		psi	psi

Summary

	Bottom
Vu	94.74 k
Horizontal As Req'd	0.33 in ²
Vertical As Req'd	0.33 in ²
Mu : Actual	1,039.18 k-ft
Bending As Req'd	4.60 in ²

Footing

f'c 2,500.0 psi
Fy 60,000.0 psi
Rebar Cover 3.000 in
Footing Thickness 23.00 in
Width 5.500 ft

Footing Dimensions

Dist. Left	5.500 ft
Wall Length	19.580 ft
Dist. Right	5.500 ft
Total Ftg Length	30.580 ft
Kern Width	5.097 ft

ADD FOOTING 22E

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 11:09AM, 1 JUN 00
Description : Collection of example problems

Scope : All programs in the Structural Engineering Library

Rev: 510002
User: KW-0502970, Ver 5.1.2, 13-Jun-1999, Wind2
(c) 1983-99 ENERCALC

Concrete Shear Wall Design

Page 2

c:\enercalc\examples.ecw:Concrete Calcs

Description Riverside Fire Station No. 1-Wall 4

Wall & Footing Stability...

	<u>Service Loads</u>	<u>ACI Eq. 9-1</u>	<u>ACI Eq. 9-2 & 9-3</u>
Total Vertical Loads	56.86 k	79.61 k	79.61 k
Overturning Moments...			
No Lateral or Short Term Loads	0.33 k-ft	0.47 k-ft	
Lat & ST Loads Applied to Left	871.98 k-ft		1,220.77 k-ft
Lat & ST Loads Applied to Right	871.31 k-ft		1,219.84 k-ft
Resultant Ecc. from Centerline...			
No Lateral or Short Term Loads	-0.006 ft	-0.006 ft	
Lat & ST Loads Applied to Left	-15.334 ft		-15.334 ft
Lat & ST Loads Applied to Right	15.323 ft		15.323 ft

Overall Wall & Footing Stability

Overturning Stability	<u>Overspinning Moment</u>	<u>Resisting Moment</u>	<u>Stability Ratio</u>
Lateral Loads Applied to Left	871.65 k-ft	869.12 k-ft	0.997 : 1
Lateral Loads Applied to Right	871.65 k-ft	869.79 k-ft	0.998 : 1
One-Way Shear Check			
@ Left End of Footing	8.903 psi	Allowable	85.000 psi
@ Right End of Footing	8.885 psi		
Bending Design	<u>M_u</u>	<u>R_u</u>	<u>As % Req'd</u>
@ Left End of Footing	39.42 k-ft	19.91 psi	0.0014
@ Right End of Footing	39.34 k-ft	19.87 psi	0.0014
Min. As % =	0.0014		1.848 in ²
			1.848 in ²

Soil Pressures

Soil Pressures	<u>Service</u>	<u>ACI Eq. 9-1</u>
Static Soil Pressure @ Left	338.48	473.88 psf
Static Soil Pressure @ Right	337.71	472.79 psf

Soil Pressures w/ Short Term Load Applied To Left	<u>Service</u>	<u>ACI Eq. 9-2 & 9-3</u>
@ Left Side of Footing	0.00 psf	0.00 psf
@ Right Side of Footing	0.00 psf	0.00 psf
Soil Pressures w/ Short Term Load Applied To Right	<u>Service</u>	<u>ACI Eq. 9-2 & 9-3</u>
@ Left Side of Footing	0.00 psf	0.00 psf
@ Right Side of Footing	0.00 psf	0.00 psf

ACI Factors (per ACI, applied internally to entered loads)

ACI 9-1 & 9-2 DL	1.400	ACI 9-2 Group Factor	0.750	UBC 1921.2.7 "1.4" Factor	1.400
ACI 9-1 & 9-2 LL	1.700	ACI 9-3 Dead Load Factor	0.900	UBC 1921.2.7 "0.9" Factor	0.900
ACI 9-1 & 9-2 ST	1.700	ACI 9-3 Short Term Factor	1.300		
....seismic = ST * :	1.100				

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 10:41AM, 1 JUN 00
Description : Collection of example problems
Scope : All programs in the Structural Engineering Library

Rev: 510002
User: EW-0602970, Ver 5.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Concrete Shear Wall Design

Page 1

c:\enercalc\examples.ecw:Concrete Calcs

Description Riverside Fire Station No. 1-Wall 12

EXISTING

General Information

Calculations are designed to ACI 318-85 and 1997 UBC Requirements

Total Wall Height	11.660 ft	Selsmic Factor	0.306
Concrete Weight	100.000 pcf	Selsmic Zone	4
Live & Short Term Load Combined		Min Wall As% for Bending	0.0030

Overburden Weight 0.00 psf

Applied Loads

Short Term Lateral Loads...

	Load	Height	Dead	Live	Short Term	Vertical	Horiz.
#1	11.920 k	11.500 ft	#1	7.000	k	11.660	4.250 ft

Wall Data

	<u>Bottom</u>
Analysis Height	0.00 ft
Wall Offset (datum)	ft
Wall Length	8.580 ft
Wall Thickness	11.000 in
fc : Concrete	2,000.0 psi
Fy : Rebar	60,000.0 psi
Effective Depth	4.800 ft

Wall Analysis

	<u>Bottom</u>			
Vs : Story Shear	14.73 k			
Ms w/ Lat Right	153.2 k-ft			
Ms w/ Lat Left	153.2 k-ft			
Uplift @ Left End	9.77 k			
Uplift @ Right	9.83 k			
Vu = Vs * Factor(s)	20.617 k			
Vu : Applied	26.34 psi			
Nu : Axial	22.64 k			
Mu : Moment	215.21 k-ft			
vc * .85	93.857 psi	psi		psi
vn:max = 1(268.33 psi		psi	psi

Summary

	<u>Bottom</u>
Vu	20.62 k
Horizontal As Req'd	0.26 in ²
Vertical As Req'd	0.16 in ²
Mu : Actual	215.21 k-ft
Bending As Req'd	1.90 in ²

Footing

fc	2,500.0 psi
Fy	60,000.0 psi
Rebar Cover	3.000 in
Footing Thickness	0.66 in
Width	2.160 ft

Footing Dimensions

Dist. Left	6.000 ft
Wall Length	8.580 ft
Dist. Right	1.830 ft
Total Flg Length	16.410 ft
Kern Width	2.735 ft

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 10:41AM, 1 JUN 00
Description : Collection of example problems

Scope : All programs in the Structural Engineering Library

Rev: 510002
User: RM-0602970, Ver 5.1.2, 13-Jun-1999, WIn32
(c) 1983-99 ENERCALC

Concrete Shear Wall Design

Page 2

c:\enercalc\examples.ecw:Concrete Calcs

Description Riverside Fire Station No. 1-Wall 12

Wall & Footing Stability...

	<u>Service Loads</u>	<u>ACI Eq. 9-1</u>	<u>ACI Eq. 9-2 & 9-3</u>
Total Vertical Loads	16.37 k	22.91 k	22.91 k
Overturning Moments...			
No Lateral or Short Term Loads	33.44 k-ft	46.81 k-ft	
Lat & ST Loads Applied to Left	120.81 k-ft		169.14 k-ft
Lat & ST Loads Applied to Right	187.69 k-ft		262.76 k-ft
Resultant Ecc. Fom Centerline...			
No Lateral or Short Term Loads	2.043 ft	2.043 ft	
Lat & ST Loads Applied to Left	-7.382 ft		-7.382 ft
Lat & ST Loads Applied to Right	11.468 ft		11.468 ft

Overall Wall & Footing Stability

Overspinning Stability	<u>Overturning Moment</u>	<u>Resisting Moment</u>	<u>Stability Ratio</u>
Lateral Loads Applied to Left	154.25 k-ft	187.71 k-ft	1.087 : 1
Lateral Loads Applied to Right	154.25 k-ft	100.84 k-ft	0.654 : 1
One-Way Shear Check			OK.
@ Left End of Footing	0.000 psi	Allowable	85.000 psi
@ Right End of Footing	0.000 psi		
Bending Design	<u>M_u</u>	<u>R_u</u>	<u>As % Req'd</u>
@ Left End of Footing	222.78 k-ft	####.## psi	0.0000
@ Right End of Footing	4.55 k-ft	427.09 psi	0.0080
Min. As % =	0.0014		As Req'd
			999.000 in ²
			0.487 in ²

Soil Pressures

Soil Pressures	Service	<u>ACI Eq. 9-1</u>
Static Soil Pressure @ Left	116.81	163.54 psf
Static Soil Pressure @ Right	806.61	1,129.25 psf

Soil Pressures w/ Short Term Load Applied To Left	<u>Service</u>	<u>ACI Eq. 9-2 & 9-3</u>
@ Left Side of Footing	6,139.23 psf	8,594.93 psf
@ Right Side of Footing	0.00 psf	0.00 psf
Soil Pressures w/ Short Term Load Applied To Right	<u>Service</u>	<u>ACI Eq. 9-2 & 9-3</u>
@ Left Side of Footing	0.00 psf	0.00 psf
@ Right Side of Footing	0.00 psf	0.00 psf

ACI Factors (per ACI, applied internally to entered loads)

ACI 9-1 & 9-2 DL	1.400	ACI 9-2 Group Factor	0.750	UBC 1921.2.7 "1.4" Factor	1.400
ACI 9-1 & 9-2 LL	1.700	ACI 9-3 Dead Load Factor	0.900	UBC 1921.2.7 "0.9" Factor	0.900
ACI 9-1 & 9-2 ST	1.700	ACI 9-3 Short Term Factor	1.300		
....seismic = ST * :	1.100				

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 10:46AM, 1 JUN 00
Description : Collection of example problems

Scope : All programs in the Structural Engineering Library

Rev: 510002
User: KW-0602870, Ver 5.1.2, 13-Jun-1999. Win32
(c) 1983-99 ENERCALC

Concrete Shear Wall Design

Page 1

C:\enercalc\examples.ecw:Concrete Calcs

Description Riverside Fire Station No. 1-Wall 14

EXISTING

General Information

Calculations are designed to ACI 318-95 and 1997 UBC Requirements

Total Wall Height	11.660 ft	Selsmic Factor	0.306
Concrete Weight	100.000 pcf	Seismic Zone	4
Live & Short Term Load Combined		Min Wall As% for Bending	0.0030
		Overburden Weight	0.00 psf

Applied Loads

Short Term Lateral Loads...		Vertical Loads...					
Load	Height	Dead	Live	Short Term	Vertical	Horiz.	
#1 73.450 k	11.500 ft	#1 11.800		k	11.860	12.250 ft	

Wall Data

	Bottom
Analysis Height	0.00 ft
Wall Offset (datum)	ft
Wall Length	24.580 ft
Wall Thickness	10.000 in
fc : Concrete	2,000.0 psi
Fy : Rebar	60,000.0 psi
Effective Depth	4.800 ft

Wall Analysis

	Bottom				
Vs : Story Shear	80.76 k				
Ms w/ Lat Right	886.8 k-ft				
Ms w/ Lat Left	886.8 k-ft				
Uplift @ Left End	18.24 k				
Uplift @ Right	18.28 k				
Vu = Vs * Factor(s)	113.062 k				
Vu : Applied	178.52 psi				
Nu : Axial	49.96 k				
Mu : Moment	1,242.86 k-ft				
vc * .85	129.042 psi				
vn:max = 10	268.33 psi	psi	psi	psi	psi

Summary

	Bottom
Vu	113.06 k
Horizontal As Req'd	0.30 in ²
Vertical As Req'd	0.30 in ²
Mu : Actual	1,242.86 k-ft
Bending As Req'd	5.84 in ²

Footing

		Footing Dimensions
fc	2,500.0 psi	Dist. Left 3.160 ft
Fy	60,000.0 psi	Wall Length 24.580 ft
Rebar Cover	3.000 in	Dist. Right 0.750 ft
Footing Thickness	0.66 in	Total Flg Length 28.490 ft
Width	1.830 ft	Kern Width 4.748 ft

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 10:46AM, 1 JUN 00
Description : Collection of example problems

Scope : All programs in the Structural Engineering Library

Rev: S10002
User: KM-0602970, Ver 5.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Concrete Shear Wall Design

Page 2

c:\enercalc\examples.ecw:Concrete Calcs

Description Riverside Fire Station No. 1-Wall 14

Wall & Footing Stability...

	<u>Service Loads</u>	<u>ACI Eq. 9-1</u>	<u>ACI Eq. 9-2 & 9-3</u>
Total Vertical Loads	35.97 k	50.36 k	50.36 k
Overturning Moments...			
No Lateral or Short Term Loads	42.53 k-ft	59.54 k-ft	
Lat & ST Loads Applied to Left	849.20 k-ft		1,188.88 k-ft
Lat & ST Loads Applied to Right	934.25 k-ft		1,307.95 k-ft
Resultant Ecc. from Centerline...			
No Lateral or Short Term Loads	1.182 ft	1.182 ft	
Lat & ST Loads Applied to Left	-23.608 ft		-23.608 ft
Lat & ST Loads Applied to Right	25.973 ft		25.973 ft

Overall Wall & Footing Stability

<u>Overturning Stability</u>	<u>Overturning Moment</u>	<u>Resisting Moment</u>	<u>Stability Ratio</u>
Lateral Loads Applied to Left	891.72 k-ft	554.92 k-ft	0.522 : 1
Lateral Loads Applied to Right	891.72 k-ft	469.87 k-ft	0.527 : 1
One-Way Shear Check			
@ Left End of Footing	0.000 psi	Allowable	85.000 psi
@ Right End of Footing	0.000 psi		
Bending Design	<u>M_u</u>	<u>R_u</u>	<u>As % Req'd</u>
@ Left End of Footing	6.79 k-ft	752.95 psi	0.0163
@ Right End of Footing	0.63 k-ft	70.16 psi	0.0016
Min. As % =	0.0014		As Req'd
			0.838 in ²
			0.081 in ²

Soil Pressures

<u>Soil Pressures</u>	<u>Service</u>	<u>ACI Eq. 9-1</u>
Static Soil Pressure @ Left	518.14	725.40 psf
Static Soil Pressure @ Right	861.70	1,206.39 psf
Soil Pressures w/ Short Term Load Applied To Left		
@ Left Side of Footing	0.00 psf	ACI Eq. 9-2 & 9-3
@ Right Side of Footing	0.00 psf	0.00 psf
Soil Pressures w/ Short Term Load Applied To Right		
@ Left Side of Footing	0.00 psf	ACI Eq. 9-2 & 9-3
@ Right Side of Footing	0.00 psf	0.00 psf

ACI Factors (per ACI, applied internally to entered loads)

ACI 9-1 & 9-2 DL	1.400	ACI 9-2 Group Factor	0.750	UBC 1921.2.7 "1.4" Factor	1.400
ACI 9-1 & 9-2 LL	1.700	ACI 9-3 Dead Load Factor	0.900	UBC 1921.2.7 "0.9" Factor	0.900
ACI 9-1 & 9-2 ST	1.700	ACI 9-3 Short Term Factor	1.300		
....seismic = ST * :	1.100				

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 10:52AM, 1 JUN 00
Description : Collection of example problems

Scope : All programs in the Structural Engineering Library

Rev: S10002
User: KW-0602970, Ver 5.1.2, 11-Jun-1999, Win32
(c) 1983-99 ENERCALC

Concrete Shear Wall Design

Page 1
c:\enercalc\examples.ecw:Concrete Calcs

Description Riverside Fire Station No. 1-Wall 14

REQUERED

General Information

Calculations are designed to ACI 318-95 and 1997 UBC Requirements

Total Wall Height 11.660 ft
Concrete Weight 100.000 pcf
Live & Short Term Load Combined

Seismic Factor 0.306
Selmsic Zone 4
Min Wall As% for Bending 0.0030
Overburden Weight 0.00 psf

Applied Loads

Short Term Lateral Loads...

#1	Load	Height	Dead	Live	Short Term	Vertical	Horiz.
	73.450 k	11.500 ft	#1	11.800	k	11.660	12.250 ft

Wall Data

Analysis Height	0.00 ft
Wall Offset	(datum) ft
Wall Length	24.580 ft
Wall Thickness	10.000 in
fc : Concrete	2,000.0 psi
Fy : Rebar	60,000.0 psi
Effective Depth	4.800 ft

Wall Analysis

<u>Bottom</u>	
Vs : Story Shear	80.76 k
Ms w/ Lat Right	886.8 k-ft
Ms w/ Lat Left	886.8 k-ft
Uplift @ Left End	18.24 k
Uplift @ Right	18.28 k
Vu = Vs * Factor(s)	113.082 k
Vu : Applied	178.52 psi
Nu : Axial	49.96 k
Mu : Moment	1,242.86 k-ft
vc * .85	129.042 psi
vn:max = 10	268.33 psi
	psi
	psi
	psi

Summary

<u>Bottom</u>	
Vu	113.06 k
Horizontal As Req'd	0.30 in ²
Vertical As Req'd	0.30 in ²
Mu : Actual	1,242.86 k-ft
Bending As Req'd	5.84 in ²

Footing

fc 2,500.0 psi
Fy 60,000.0 psi
Rebar Cover 3.000 in
Footing Thickness 24.00 in
Width 4.500 ft

Footing Dimensions

Dist. Left	4.500 ft
Wall Length	24.580 ft
Dist. Right	4.400 ft
Total Ftg Length	33.480 ft
Kem Width	5.580 ft

ADD FOOTING SIZE

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Rev: 510002
User: XM-0602970, Ver 5.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 10:52AM, 1 JUN 00
Description : Collection of example problems
Scope : All programs in the Structural Engineering Library

Concrete Shear Wall Design c:\enercalc\examples.ecw:Concrete Calcs Page 2
Description Riverside Fire Station No. 1-Wall 14

Wall & Footing Stability...

	<u>Service Loads</u>	<u>ACI Eq. 9-1</u>	<u>ACI Eq. 9-2 & 9-3</u>
Total Vertical Loads	65.82 k	92.14 k	92.14 k
Overturning Moments...			
No Lateral or Short Term Loads	1.31 k-ft	1.84 k-ft	
Lat & ST Loads Applied to Left	1,047.49 k-ft		1,466.48 k-ft
Lat & ST Loads Applied to Right	1,050.11 k-ft		1,470.16 k-ft
Resultant Ecc. from Centerline...			
No Lateral or Short Term Loads	0.020 ft	0.020 ft	
Lat & ST Loads Applied to Left	-15.915 ft		-15.915 ft
Lat & ST Loads Applied to Right	15.955 ft		15.955 ft

Overall Wall & Footing Stability

<u>Overturning Stability</u>	<u>Overturning Moment</u>	<u>Resisting Moment</u>	<u>Stability Ratio</u>
Lateral Loads Applied to Left	1,048.80 k-ft	1,103.06 k-ft	1.052 : 1
Lateral Loads Applied to Right	1,048.80 k-ft	1,100.44 k-ft	1.049 : 1
One-Way Shear Check			
@ Left End of Footing	95.593 psi	Allowable	85.000 psi
@ Right End of Footing	95.593 psi		
Bending Design	<u>M_u</u>	<u>R_u</u>	<u>As % Req'd</u>
@ Left End of Footing	338.67 k-ft	189.62 psi	0.0033
@ Right End of Footing	333.13 k-ft	186.52 psi	0.0033
Min. As % =	0.0014		3.780 in ²
			3.780 in ²

Soil Pressures

<u>Soil Pressures</u>	<u>Service</u>	<u>ACI Eq. 9-1</u>	<u>ACI Eq. 9-2 & 9-3</u>
Static Soil Pressure @ Left	435.29	609.40 psf	
Static Soil Pressure @ Right	438.41	613.77 psf	
Soil Pressures w/ Short Term Load Applied To Left			
@ Left Side of Footing	11,825.84 psf	16,556.18 psf	
@ Right Side of Footing	0.00 psf	0.00 psf	
Soil Pressures w/ Short Term Load Applied To Right			
@ Left Side of Footing	0.00 psf	0.00 psf	
@ Right Side of Footing	12,426.82 psf	17,397.55 psf	

ACI Factors (per ACI, applied internally to entered loads)

ACI 9-1 & 9-2 DL	1.400	ACI 9-2 Group Factor	0.750	UBC 1921.2.7 "1.4" Factor	1.400
ACI 9-1 & 9-2 LL	1.700	ACI 9-3 Dead Load Factor	0.900	UBC 1921.2.7 "0.9" Factor	0.900
ACI 9-1 & 9-2 ST	1.700	ACI 9-3 Short Term Factor	1.300		
....seismic = ST * :	1.100				

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 11:39AM, 1 JUN 00
Description : Collection of example problems
Scope : All programs in the Structural Engineering Library

Rev: 510002
User: KW-0602970, Ver 5.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Concrete Shear Wall Design

Page 1

C:\enercalc\examples.ecw:Concrete Calcs

Description Riverside Fire Station No. 1-Wall 18

EXISTING

General Information

Calculations are designed to ACI 318-95 and 1997 UBC Requirements

Total Wall Height	11.660 ft	Seismic Factor	0.306
Concrete Weight	100.000 pcf	Seismic Zone	4
Live & Short Term Load Combined		Min Wall As% for Bending	0.0030

Overburden Weight 0.00 psf

Applied Loads

Short Term Lateral Loads...

	Load	Height	Dead	Live	Short Term	Vertical	Horiz.
#1	70.630 k	11.500 ft	#1	12.800	k	11.660	16.000 ft

Wall Data

	Bottom	2nd Level
Analysis Height	0.00 ft	11.660 ft
Wall Offset (datum)	ft	ft
Wall Length	32.000 ft	32.000 ft
Wall Thickness	10.000 in	10.000 in
fc : Concrete	2,000.0 psi	2,000.0 psi
Fy : Rebar	60,000.0 psi	60,000.0 psi
Effective Depth	4.800 ft	4.800 ft

Wall Analysis

	Bottom	2nd Level
Vs : Story Shear	80.14 k	k
Ms w/ Lat Right	867.7 k-ft	k-ft
Ms w/ Lat Left	867.7 k-ft	k-ft
Uplift @ Left End	5.17 k	k
Uplift @ Right	5.17 k	k
Vu = Vs * Factor(s)	112.202 k	k
Vu : Applied	171.67 psi	psi
Nu : Axial	61.45 k	k
Mu : Moment	1,214.80 k-ft	k-ft
vc * .85	128.844 psi	125.443 psi
vn:max = 1C	268.33 psi	268.33 psi
		psi
		psi
		psi

Summary

	Bottom	2nd Level
Vu	112.20 k	k
Horizontal As Req'd	0.30 in ²	0.24 in ²
Vertical As Req'd	0.30 in ²	0.14 in ²
Mu : Actual	1,214.80 k-ft	k-ft
Bending As Req'd	5.67 in ²	1.73 in ²

Footing

		Footing Dimensions
fc	2,500.0 psi	Dist. Left 2.000 ft
Fy	60,000.0 psi	Wall Length 32.000 ft
Rebar Cover	3.000 in	Dist. Right 1.500 ft
Footing Thickness	10.00 in	Total Flg Length 35.500 ft
Width	2.000 ft	Kern Width 5.917 ft

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 11:39AM, 1 JUN 00
Description : Collection of example problems

Scope : All programs in the Structural Engineering Library

Rev: 510002
User: RW-0502970, Ver 5.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Concrete Shear Wall Design

Page 2

c:\enercalc\examples.ecw:Concrete Calcs

Description Riverside Fire Station No. 1-Wall 18

Wall & Footing Stability...

	<u>Service Loads</u>	<u>ACI Eq. 9-1</u>	<u>ACI Eq. 9-2 & 9-3</u>
Total Vertical Loads	49.81 k	69.73 k	69.73 k
Overturning Moments...			
No Lateral or Short Term Loads	10.97 k-ft	15.36 k-ft	
Lat & ST Loads Applied to Left	923.53 k-ft		1,292.94 k-ft
Lat & ST Loads Applied to Right	945.47 k-ft		1,323.66 k-ft
Resultant Ecc. from Centerline...			
No Lateral or Short Term Loads	0.220 ft	0.220 ft	
Lat & ST Loads Applied to Left	-18.541 ft		-18.541 ft
Lat & ST Loads Applied to Right	18.982 ft		18.982 ft

Overall Wall & Footing Stability

<u>Overturning Stability</u>	<u>Overturning Moment</u>	<u>Resisting Moment</u>	<u>Stability Ratio</u>
Lateral Loads Applied to Left	934.50 k-ft	895.10 k-ft	0.958 : 1
Lateral Loads Applied to Right	934.50 k-ft	873.15 k-ft	0.934 : 1
One-Way Shear Check			
@ Left End of Footing	18.791 psi	Allowable	85.000 psi
@ Right End of Footing	13.067 psi		
Bending Design	<u>M_u</u>	<u>R_u</u>	<u>As % Req'd</u>
@ Left End of Footing	3.79 k-ft	42.95 psi	0.0014
@ Right End of Footing	2.29 k-ft	25.98 psi	0.0014
Min. As % =	0.0014		<u>As Req'd</u>
			0.235 in ²
			0.235 in ²

Soil Pressures

<u>Soil Pressures</u>	<u>Service</u>	<u>ACI Eq. 9-1</u>
Static Soil Pressure @ Left	675.43	945.60 psf
Static Soil Pressure @ Right	727.67	1,018.74 psf
Soil Pressures w/ Short Term Load Applied To Left	<u>Service</u>	<u>ACI Eq. 9-2 & 9-3</u>
@ Left Side of Footing	0.00 psf	0.00 psf
@ Right Side of Footing	0.00 psf	0.00 psf
Soil Pressures w/ Short Term Load Applied To Right	<u>Service</u>	<u>ACI Eq. 9-2 & 9-3</u>
@ Left Side of Footing	0.00 psf	0.00 psf
@ Right Side of Footing	0.00 psf	0.00 psf

ACI Factors (per ACI, applied internally to entered loads)

ACI 9-1 & 9-2 DL	1.400	ACI 9-2 Group Factor	0.750	UBC 1921.2.7 "1.4" Factor	1.400
ACI 9-1 & 9-2 LL	1.700	ACI 9-3 Dead Load Factor	0.900	UBC 1921.2.7 "0.9" Factor	0.900
ACI 9-1 & 9-2 ST	1.700	ACI 9-3 Short Term Factor	1.300		
....seismic = ST * :	1.100				

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 2:10PM, 1 JUN 00
Description : Collection of example problems

Scope : All programs in the Structural Engineering Library

Rev: 510002
User: KW-0602970, Ver 5.1.2, 13-Jun-1999, Min32
(c) 1982-99 ENERCALC

Concrete Shear Wall Design

Page 1
c:\enercalc\examples.ecw:Concrete Calcs

Description Riverside Fire Station No. 1-Tower

EXISTING

General Information

Calculations are designed to ACI 318-95 and 1997 UBC Requirements

Total Wall Height	16.000 ft	Seismic Factor	0.306
Concrete Weight	100.000 pcf	Seismic Zone	4
Live & Short Term Load Combined		Min Wall As% for Bending	0.0030
		Overburden Weight	0.00 psf

Applied Loads

Short Term Lateral Loads...

	Load	Height	Vertical Loads...	Dead	Live	Short Term	Vertical	Horiz.
#1	16.250 k	35.750 ft	#1			k		ft

Wall Data

	Bottom	2nd Level
Analysis Height	0.00 ft	35.750 ft
Wall Offset (datum)	ft	ft
Wall Length	13.000 ft	13.000 ft
Wall Thickness	8.000 in	8.000 in
f'c : Concrete	2,000.0 psi	2,000.0 psi
Fy : Rebar	60,000.0 psi	60,000.0 psi
Effective Depth	4.800 ft	4.800 ft

Wall Analysis

	Bottom	2nd Level
Vs : Story Shear	25.73 k	5.24 k
Ms w/ Lat Right	614.9 k-ft	51.7 k-ft
Ms w/ Lat Left	614.9 k-ft	-51.7 k-ft
Uplift @ Left End	40.37 k	k
Uplift @ Right	40.37 k	k
Vu = Vs * Factor(s)	28.690 k	k
Vu : Applied	49.37 psi	psi
Nu : Axial	19.41 k	k
Mu : Moment	860.84 k-ft	72.41 k-ft
vc * .85	50.551 psi	psi
vn:max = 10	268.33 psi	psi
		psi

Summary

	Bottom	2nd Level
Vu	28.69 k	k
Horizontal As Req'd	0.24 in ²	0.00 in ²
Vertical As Req'd	0.24 in ²	in ²
Mu : Actual	860.84 k-ft	72.41 k-ft
Bending As Req'd	3.91 in ²	1.38 in ²

Footing

fc	2,500.0 psi
Fy	60,000.0 psi
Rebar Cover	3.000 in
Footing Thickness	10.00 in
Width	2.000 ft

Footing Dimensions	
Dist. Left	0.750 ft
Wall Length	13.000 ft
Dist. Right	0.750 ft
Total Ftg Length	14.500 ft
Kern Width	2.417 ft

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 2:10PM, 1 JUN 00
Description : Collection of example problems

Scope : All programs in the Structural Engineering Library

Rev: 510002
User: KW-0602970, Ver 5.1.2, 13-Jun-1999. Win32
(c) 1983-99 ENERCALC

Concrete Shear Wall Design

Page 2

c:\enercalc\examples.ecw:Concrete Calcs

Description Riverside Fire Station No. 1-Tower

Wall & Footing Stability...

	<u>Service Loads</u>	<u>ACI Eq. 9-1</u>	<u>ACI Eq. 9-2 & 9-3</u>
Total Vertical Loads	16.28 k	22.80 k	22.80 k
Overturning Moments...			
No Lateral or Short Term Loads	0.00 k-ft	0.00 k-ft	
Lat & ST Loads Applied to Left	631.96 k-ft		884.74 k-ft
Lat & ST Loads Applied to Right	631.96 k-ft		884.74 k-ft
Resultant Ecc. from Centerline...			
No Lateral or Short Term Loads	0.000 ft	0.000 ft	
Lat & ST Loads Applied to Left	-38.810 ft		-38.810 ft
Lat & ST Loads Applied to Right	38.810 ft		38.810 ft

Overall Wall & Footing Stability

Overspinning Stability	Overspinning Moment	Resisting Moment	Stability Ratio
Lateral Loads Applied to Left	715.76 k-ft	118.05 k-ft	0.165 : 1
Lateral Loads Applied to Right	715.76 k-ft	118.05 k-ft	0.165 : 1
One-Way Shear Check			No Go!
@ Left End of Footing	1.835 psi	Allowable	85.000 psi
@ Right End of Footing	1.835 psi		
Bending Design	M _u	R _u	As % Req'd
@ Left End of Footing	0.44 k-ft	5.01 psi	0.0014
@ Right End of Footing	0.44 k-ft	5.01 psi	0.0014
Min. As % =	0.0014		0.235 in ²
			0.235 in ²

Soil Pressures

Soil Pressures	Service	ACI Eq. 9-1
Static Soil Pressure @ Left	561.49	786.09 psf
Static Soil Pressure @ Right	561.49	786.09 psf
Soil Pressures w/ Short Term Load Applied To Left	Service	ACI Eq. 9-2 & 9-3
@ Left Side of Footing	0.00 psf	0.00 psf
@ Right Side of Footing	0.00 psf	0.00 psf
Soil Pressures w/ Short Term Load Applied To Right	Service	ACI Eq. 9-2 & 9-3
@ Left Side of Footing	0.00 psf	0.00 psf
@ Right Side of Footing	0.00 psf	0.00 psf

ACI Factors (per ACI, applied internally to entered loads)

ACI 9-1 & 9-2 DL	1.400	ACI 9-2 Group Factor	0.750	UBC 1921.2.7 "1.4" Factor	1.400
ACI 9-1 & 9-2 LL	1.700	ACI 9-3 Dead Load Factor	0.900	UBC 1921.2.7 "0.9" Factor	0.900
ACI 9-1 & 9-2 ST	1.700	ACI 9-3 Short Term Factor	1.300		
....seismic = ST :	1.100				

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MOB Date: 2:58PM, 1 JUN 00
Description : Collection of example problems
Scope : All programs in the Structural Engineering Library

Rev: 510002
User: KW-0602970, Ver 5.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Concrete Shear Wall Design

Page 1

c:\enercalc\examples.ecw:Concrete Calcs

Description Riverside Fire Station No. 1-Tower

REQUIRED

General Information

Calculations are designed to ACI 318-95 and 1997 UBC Requirements

Total Wall Height	35.750 ft
Concrete Weight	150.000 psf
Live & Short Term Load Combined	

Seismic Factor	0.306
Seismic Zone	4
Min Wall As% for Bending	0.0030
Overburden Weight	0.00 psf

Applied Loads

Short Term Lateral Loads...

	Load	Height	Dead	Live	Short Term	Vertical	Horiz.
#1	18.250 k	35.750 ft	#1			k	ft

Wall Data

	Bottom	2nd Level
Analysis Height	0.00 ft	35.750 ft
Wall Offset (datum)	ft	ft
Wall Length	13.000 ft	13.000 ft
Wall Thickness	8.000 in	8.000 in
f _c : Concrete	2,000.0 psi	2,000.0 psi
F _y : Rebar	60,000.0 psi	60,000.0 psi
Effective Depth	4.800 ft	4.800 ft

Wall Analysis

	Bottom	2nd Level			
V _s : Story Shear	30.47 k		k		
M _s w/ Lat Right	835.1 k-ft		k-ft		
M _s w/ Lat Left	835.1 k-ft		k-ft		
Uplift @ Left End	41.00 k		k		
Uplift @ Right	41.00 k		k		
V _u = V _s * Factor(s)	42.660 k		k		
V _u : Applied	49.37 psi		psi		
N _u : Axial	65.06 k		k		
M _u : Moment	1,169.20 k-ft		k-ft		
v _c * .85	57.864 psi	125.443 psi	psi		
v _n :max = 1	268.33 psi	268.33 psi	psi		psi

Summary

	Bottom	2nd Level
V _u	42.66 k	
Horizontal As Req'd	0.24 in ²	0.19 in ²
Vertical As Req'd	0.24 in ²	0.12 in ²
M _u : Actual	1,169.20 k-ft	k-ft
Bending As Req'd	999.00 in ²	1.38 in ²

Footing

f _c	2,500.0 psi
F _y	60,000.0 psi
Rebar Cover	3.000 in
Footing Thickness	23.00 in
Width	7.000 ft

*ADD TO LED
FOOTING*

Footing Dimensions

Dist. Left	12.000 ft
Wall Length	13.000 ft
Dist. Right	12.000 ft
Total Ftg Length	37.000 ft
Kern Width	6.167 ft

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 2:58PM, 1 JUN 00
Description : Collection of example problems
Scope : All programs in the Structural Engineering Library

Rev: 510002
User: KW-0602970, Ver 5.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Concrete Shear Wall Design

Page 2

C:\enercalc\examples.ecw\Concrete Calcs

Description Riverside Fire Station No. 1-Tower

Wall & Footing Stability...

	<u>Service Loads</u>	<u>ACI Eq. 9-1</u>	<u>ACI Eq. 9-2 & 9-3</u>
Total Vertical Loads	120.94 k	169.31 k	169.31 k
Overturning Moments...			
No Lateral or Short Term Loads	0.00 k-ft	0.00 k-ft	
Lat & ST Loads Applied to Left	893.55 k-ft		1,250.97 k-ft
Lat & ST Loads Applied to Right	893.55 k-ft		1,250.97 k-ft
Resultant Ecc. from Centerline...			
No Lateral or Short Term Loads	0.000 ft	0.000 ft	
Lat & ST Loads Applied to Left	-7.389 ft		-7.389 ft
Lat & ST Loads Applied to Right	7.389 ft		7.389 ft

Overall Wall & Footing Stability

<u>Overturning Stability</u>	<u>Overturning Moment</u>	<u>Resisting Moment</u>	<u>Stability Ratio</u>
Lateral Loads Applied to Left	893.55 k-ft	2,237.34 k-ft	2.504 : 1
Lateral Loads Applied to Right	893.55 k-ft	2,237.34 k-ft	2.504 : 1
One-Way Shear Check			
@ Left End of Footing	62.115 psi	Allowable	85.000 psi
@ Right End of Footing	62.115 psi		
Bending Design	<u>M_u</u>	<u>F_u</u>	<u>As % Req'd</u>
@ Left End of Footing	643.64 k-ft	255.41 psi	0.0045
@ Right End of Footing	643.64 k-ft	255.41 psi	0.0045
Min. As % =	0.0014		

Soil Pressures

<u>Soil Pressures</u>	<u>Service</u>	<u>ACI Eq. 9-1</u>	<u>ACI Eq. 9-2 & 9-3</u>
Static Soil Pressure @ Left	466.94	653.72 psf	
Static Soil Pressure @ Right	466.94	653.72 psf	
Soil Pressures w/ Short Term Load Applied To Left		<u>Service</u>	<u>ACI Eq. 9-2 & 9-3</u>
@ Left Side of Footing	1,036.57 psf	1,451.20 psf	
@ Right Side of Footing	0.00 psf	0.00 psf	
Soil Pressures w/ Short Term Load Applied To Right		<u>Service</u>	<u>ACI Eq. 9-2 & 9-3</u>
@ Left Side of Footing	0.00 psf	0.00 psf	
@ Right Side of Footing	1,036.57 psf	1,451.20 psf	

ACI Factors (per ACI, applied internally to entered loads)

ACI 9-1 & 9-2 DL	1.400	ACI 9-2 Group Factor	0.750	UBC 1921.2.7 "1.4" Factor	1.400
ACI 9-1 & 9-2 LL	1.700	ACI 9-3 Dead Load Factor	0.900	UBC 1921.2.7 "0.9" Factor	0.900
ACI 9-1 & 9-2 ST	1.700	ACI 9-3 Short Term Factor	1.300		
....seismic = ST * :	1.100				

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 12:51PM, 1 JUN 00
Description : Collection of example problems

Scope : All programs in the Structural Engineering Library

Rev: S10002
User: KW-0602970, Ver 5.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Concrete Shear Wall Design

Page 1

c:\enercalc\examples.ecw:Concrete Calcs

Description Riverside Fire Station No. 1 - Wall 18 - APPARATUS - NORTH WALL

EXISTING

General Information

Calculations are designed to ACI 318-95 and 1997 UBC Requirements

Total Wall Height	16.000 ft	Seismic Factor	0.305
Concrete Weight	100.000 pcf	Seismic Zone	4
Live & Short Term Load Combined		Min Wall As% for Bending	0.0030
		Overburden Weight	0.00 psf

Applied Loads

Short Term Lateral Loads...

Load	Height	Dead	Live	Short Term	Vertical	Horiz.
#1 54.150 k	16.000 ft	#1 14.100		k	16.000	1.000 ft

Wall Data

	Bottom	2nd Level
Analysis Height	0.00 ft	16.000 ft
Wall Offset (datum)	ft	ft
Wall Length	7.250 ft	7.250 ft
Wall Thickness	11.000 in	11.000 in
f'c : Concrete	2,000.0 psi	2,000.0 psi
Fy : Rebar	60,000.0 psi	60,000.0 psi
Effective Depth	4.800 ft	4.800 ft

Wall Analysis

	Bottom	2nd Level
Vs : Story Shear	57.40 k	k
Ms w/ Lat Right	855.4 k-ft	k-ft
Ms w/ Lat Left	855.4 k-ft	k-ft
Uplift @ Left End	105.62 k	k
Uplift @ Right	115.83 k	k
Vu = Vs * Factor(s)	80.365 k	k
Vu : Applied	119.85 psi	psi
Nu : Axial	34.63 k	k
Mu : Moment	1,301.22 k-ft	k-ft
vc : .85	53.771 psi	125.443 psi
vn:max = 1C	268.33 psi	268.33 psi
		psi
		psi
		psi

Summary

	Bottom	2nd Level
Vu	80.37 k	k
Horizontal As Req'd	0.33 in ²	0.26 in ²
Vertical As Req'd	0.33 in ²	0.16 in ²
Mu : Actual	1,301.22 k-ft	k-ft
Bending As Req'd	6.03 in ²	1.90 in ²

Footing

f'c	2,500.0 psi
Fy	60,000.0 psi
Rebar Cover	3.000 in
Footing Thickness	12.00 in
Width	1.500 ft

Footing Dimensions

Dist. Left	0.750 ft
Wall Length	7.250 ft
Dist. Right	5.000 ft
Total Ftg Length	13.000 ft
Kern Width	2.167 ft

Integrated Design Services, Inc
250 N. Golden Circle Drive
Suite 105
Santa Ana, California 92705
(714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
Dsgnr: MDB Date: 12:51PM, 1 JUN 00
Description : Collection of example problems

Scope : All programs in the Structural Engineering Library

Rev: S1.0002
User: XM-0602970, Ver 5.1.2, 13-Jun-1999, Win32
(c) 1983-99 ENERCALC

Concrete Shear Wall Design

Page 2

c:\enercalc\examples.ecw:Concrete Calcs

Description Riverside Fire Station No. 1-Wall 18 APPARATUS - NORTH WALL

Wall & Footing Stability...

	<u>Service Loads</u>	<u>ACI Eq. 9-1</u>	<u>ACI Eq. 9-2 & 9-3</u>
Total Vertical Loads	26.68 k	37.36 k	37.36 k
Overturning Moments...			
No Lateral or Short Term Loads	89.57 k-ft	125.40 k-ft	
Lat & ST Loads Applied to Left	1,039.40 k-ft		1,455.17 k-ft
Lat & ST Loads Applied to Right	860.26 k-ft		1,204.37 k-ft
Resultant Ecc. Fom Centerline...			
No Lateral or Short Term Loads	-3.357 ft	-3.357 ft	
Lat & ST Loads Applied to Left	-38.953 ft		-38.953 ft
Lat & ST Loads Applied to Right	32.240 ft		32.240 ft

Overall Wall & Footing Stability

<u>Overturning Stability</u>	<u>Overspinning Moment</u>	<u>Resisting Moment</u>	<u>Stability Ratio</u>
Lateral Loads Applied to Left	949.83 k-ft	83.87 k-ft	0.088 : 1
Lateral Loads Applied to Right	949.83 k-ft	263.01 k-ft	0.277 : 1
One-Way Shear Check			N.G.
@ Left End of Footing	0.000 psi	Allowable	85.000 psi
@ Right End of Footing	1.409 psi		
Bending Design	<u>M_u</u>	<u>R_u</u>	<u>As % Req'd</u>
@ Left End of Footing	2.17 k-ft	19.84 psi	0.0014
@ Right End of Footing	0.41 k-ft	3.74 psi	0.0014
Min. As % =	0.0014		0.227 in ²
			0.227 in ²

Soil Pressures

<u>Soil Pressures</u>	<u>Service</u>	<u>ACI Eq. 9-1</u>
Static Soil Pressure @ Left	3,773.00	5,282.20 psf
Static Soil Pressure @ Right	0.00	0.00 psf
Soil Pressures w/ Short Term Load Applied To Left		
@ Left Side of Footing	0.00 psf	0.00 psf
@ Right Side of Footing	0.00 psf	0.00 psf
Soil Pressures w/ Short Term Load Applied To Right		
@ Left Side of Footing	0.00 psf	0.00 psf
@ Right Side of Footing	0.00 psf	0.00 psf

ACI Factors (per ACI, applied internally to entered loads)

ACI 9-1 & 9-2 DL	1.400	ACI 9-2 Group Factor	0.750	UBC 1921.2.7 "1.4" Factor	1.400
ACI 9-1 & 9-2 LL	1.700	ACI 9-3 Dead Load Factor	0.900	UBC 1921.2.7 "0.9" Factor	0.900
ACI 9-1 & 9-2 ST	1.700	ACI 9-3 Short Term Factor	1.300		
....seismic = ST * :	1.100				

Integrated Design Services, Inc
 250 N. Golden Circle Drive
 Suite 105
 Santa Ana, California 92705
 (714) 541-5440 x15

Title : ENERCALC Example Problems Job # 97-000001
 Dsgnr: MDB Date: 12:58PM, 1 JUN 00
 Description : Collection of example problems
 Scope : All programs in the Structural Engineering Library

Rev. S10002
 User: KW-0602970, Ver 5.1.2, 13-Jun-1999, Wla32
 (cl: 1983-99 ENERCALC)

Concrete Shear Wall Design

Page 2

c:\enercalc\examples.ecw:Concrete Calcs

Description Riverside Fire Station No. 1-Apparatus North Wall

REQUIRED

Wall & Footing Stability...

	Service Loads	ACI Eq. 9-1	ACI Eq. 9-2 & 9-3
Total Vertical Loads	94.84 k	132.77 k	132.77 k
Oversetting Moments...			
No Lateral or Short Term Loads	37.01 k-ft	51.82 k-ft	
Lat & ST Loads Applied to Left	1,039.47 k-ft		1,455.25 k-ft
Lat & ST Loads Applied to Right	965.44 k-ft		1,351.62 k-ft
Resultant Ecc. from Centerline...			
No Lateral or Short Term Loads	-0.390 ft	-0.390 ft	
Lat & ST Loads Applied to Left	-10.961 ft		-10.961 ft
Lat & ST Loads Applied to Right	10.180 ft		10.180 ft

Overall Wall & Footing Stability

Oversetting Stability	Oversetting Moment	Resisting Moment	Stability Ratio
Lateral Loads Applied to Left	1,002.45 k-ft	1,539.63 k-ft	1.536 : 1
Lateral Loads Applied to Right	1,002.45 k-ft	1,613.65 k-ft	1.610 : 1
One-Way Shear Check			
@ Left End of Footing	52.604 psi	Allowable	85.000 psi
@ Right End of Footing	49.034 psi		
Bending Design	M _u	R _u	As % Req'd
@ Left End of Footing	983.72 k-ft	248.41 psi	0.0044
@ Right End of Footing	900.42 k-ft	227.38 psi	0.0040
Min. As % =	0.0014		As Req'd
			11.657 in ²
			10.606 in ²

Soil Pressures

Soil Pressures	Service	ACI Eq. 9-1
Static Soil Pressure @ Left	277.55	388.57 psf
Static Soil Pressure @ Right	241.03	337.44 psf
Soil Pressures w/ Short Term Load Applied To Left	Service	ACI Eq. 9-2 & 9-3
@ Left Side of Footing	1,014.71 psf	1,420.60 psf
@ Right Side of Footing	0.00 psf	0.00 psf
Soil Pressures w/ Short Term Load Applied To Right	Service	ACI Eq. 9-2 & 9-3
@ Left Side of Footing	0.00 psf	0.00 psf
@ Right Side of Footing	891.82 psf	1,248.54 psf

ACI Factors (per ACI, applied internally to entered loads)

ACI 9-1 & 9-2 DL	1.400	ACI 9-2 Group Factor	0.750	UBC 1921.2.7 "1.4" Factor	1.400
ACI 9-1 & 9-2 LL	1.700	ACI 9-3 Dead Load Factor	0.900	UBC 1921.2.7 "0.9" Factor	0.900
ACI 9-1 & 9-2 ST	1.700	ACI 9-3 Short Term Factor	1.300		
...seismic = ST * :	1.100				